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A Respiratory Study of the Influence of a Moderate Amount of Physical Training

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The observations that are herein recorded were made on two non-athletic men, one of them of middle age and the other in the early twenties.* The purpose of the investigation was to follow, step by step, the changes in the gaseous metabolism and breathing that occur during and after a period of daily indulgence in a moderate amount of physical exercise.

There can be no doubt but that a regular course of physical training gives greater strength and efficiency to the body and improves its nutritive condition. The moderate exercise taken by our subjects resulted in a noticeable increase in the feeling of well being and in mental alertness. Both of the men experienced an increased appetite for food and an augmented capacity for doing physical work.

During the training period, which lasted two months, each man spent approximately an hour each day at some form of vigorous physical exercise. In the early fall this consisted mostly of tennis and later of handball and swimming, with occasional running on an indoor track. Sometimes setting-up exercises for from 20 to 30 minutes had to satisfy the demand for activity.

Investigational observations were ordinarily made on each man once a week. The basal metabolic rate was determined in the early morning before the subject arose from bed. Then during the afternoon the man was put to work on a bicycle ergometer of the Krogh type, where he carried, as the occasion demanded, a number of loads of work. During each work period the expired air was collected in Douglas bags and later analyzed for carbon dioxide and oxygen. From the data obtained it was possible to determine which loads constituted normal-, crest-, and over-loads of work; and to follow any changes in the basal metabolism, in the utilization of oxygen, in the output of carbon dioxide, and in the amount of pure air breathed per minute.

The change in the position of the crest-load. The muscular capacity of a man is measured by the extent to which he can call upon his body for increased effort. When the work demands continuous effort over a considerable period of time, the individual works comfortably so long as he

* For more detailed discussion of the data see Schneider, E. C., R. W. Clarke, and G. C. Ring. 1927. American Journal of Physiology, lxxxi, 255, and Schneider, E. C., and G. C. Ring. 1929. American Journal of Physiology, lixi, 103.

maintains an approximate equilibrium between the oxygen which his muscles require and that which he absorbs. Briggs found that he could climb a mountain more rapidly and with less fatigue if he breathed air much enriched in oxygen; but that seasoned miners, when called upon to do heavy work, were indifferent to the addition of oxygen. It is known that an important difference between the seasoned miner and the untrained man is that the oxygen supplying mechanisms of the body of the trained man are more adequately developed to meet the call of the body for oxygen. It is often found that normal persons can meet a demand of not more than 1500 cc. of oxygen, whereas, as has been shown by Henderson and Haggard, a trained athlete is frequently able to meet a demand of from 3500 to 4000 cc. per minute.

Briggs has made a distinction between a normal-load, crest-load, and over-load of work on the basis of oxygen absorption. The investigations of Hill and Meyerhof have shown that the muscles are capable, during a short period of intense exertion, of developing an amount of energy far in excess of the oxygen simultaneously absorbed. During such periods of work, the body goes into debt for oxygen and must pay this debt during rest after exertion. According to Briggs, when a normal-load of work is being carried the oxygen supply is at that time adequate to meet the needs of the muscles, but with an over-load it is inadequate. The crest-load is that one in which the oxygen supplying mechanisms, working at full capacity, are just able to supply the oxygen needs and thus maintain an even balance between the call for and the use of oxygen.

The percentage of carbon dioxide in the expired air of a work period has been employed by Briggs to determine which load of work constitutes the crest-load. When exertion of increasing magnitudes is studied, it is found that the percentage of expired carbon dioxide at first rises and then falls. So long as the carbon dioxide percentage rises proportionately with each added increment of work the loads are considered normal; when the percentage does not rise proportionately, or begins to decrease, an over-load has been reached. The crest-load is that load for which the percentage of exhaled carbon dioxide is largest. The following example taken from one of our experiments illustrates the method of finding the crest-load. The man's expired air, when he was sitting quietly, contained 3.45 per cent of carbon dioxide; when he was doing 2000 ft. lbs. of work per minute on the bicycle ergometer for a period of 10 minutes, the exhaled air contained 4.01 per cent of carbon dioxide; with a load of 4000 ft. lbs. it contained 4.72 per cent; with one of 6000 ft. lbs., 5.21 per cent; and with 8000 ft. lbs., 4.81 per cent. In this experiment, therefore, the subject's crest-load was 6,000 ft. lbs., since this was the load of work at which the percentage of exhaled carbon dioxide was highest.

The crest-load should be increased by physical training and decreased by disease. Just how much it can be increased by training, and at what rate, has not heretofore been determined. Our experiments show that

it is increased by moderate daily exercise and again decreased by the neglect of physical exercise.

The crest-load of the younger of our two subjects was 6000 ft. lbs. in the pre-training period. It advanced to 7000 ft. lbs. during the first week of training, then more slowly to 8000 ft. lbs. by the end of the fifth week, and finally to 9000 ft. lbs. at the end of the seventh week of training. Then, because of a Thanksgiving day recess with complete neglect of exercise for four days, and a less regular indulgence in exercise thereafter, the crest-load dropped back to around 8000 ft. lbs. In the period immediately after the discontinuance of training the crest-load could not be so clearly determined as it had been during the period of training. As has been said, a slump in the crest-load began as training was tapered off; but the crest-load was still nearly 8000 ft. lbs. for five weeks of the post-training period. Later, when it could not be so definitely placed, the carbon dioxide percentage in the expired air was practically the same for loads of 4000, 6000, and sometimes 8000 ft. lbs. The crest-load certainly was then not larger than 6000 ft. lbs.

The older of our two subjects was in rather poor condition prior to the period of training. His crest-load was then only 2000 ft. lbs. This was advanced to 4000 ft. lbs. with his first week of training and to 6000 ft. lbs. by the end of the second week, where it remained during the next three weeks. Later there occurred a further advance to 7000 ft. lbs., which was reached at the end of the sixth week of training. The crest-load remained at 7000 ft. lbs. during the next three weeks; then, as exercise was less faithfully taken, it shifted back to 6000 ft. lbs. This subject underwent an appendectomy about three weeks after exercise was discontinued and was not again tested for the position of his crest-load for five weeks. At that time the crest-load could not be satisfactorily determined, but it was not clearly above 2000 ft. lbs. For some weeks thereafter it ranged between 4000 and 5000 ft. lbs.

The above observations show that even the first week of moderate physical training increases the load-carrying ability, but that from five to seven weeks of faithful training are required to bring about the full effect. They also show that any let-down in the amount of daily work at once reduces the crest-load, but that even with complete neglect of exercise some degree of the beneficial gain is maintained for several months.

Minute-volume of breathing. In accordance with the well known fact that the trained man breathes much less air for the same accomplishment than does the untrained subject, we also found that a moderate amount of daily exercise reduces the amount of air inhaled during a period of work. The change was wrought so gradually that it was impossible to determine just when it began, but it was slightly in evidence by the end of the second week of training. The maximum reduction was reached in from four to six weeks.

The reduction in the minute-volume of breathing was fairly large, but was most conspicuous with heavy loads of work. The younger of our subjects showed, as a result of training, a reduction of about 15 per cent for a load of 4000 ft. lbs.; his average minute-volume before training was 32.4 liters and during training, 27.6 liters. With a load of 8000 ft. lbs. this subject breathed 17 per cent less air when in training than when out of training. He averaged 56.5 liters per minute before training and 46.9 liters when in training. Our older subject showed even a greater change. With a load of 4000 ft. lbs. he at first breathed 36.2 liters per minute and during the last part of the training period only 30.1 liters. Training, therefore, for this load brought about a reduction of 16.6 per cent in the volume of air breathed. With a load of 6000 ft. lbs. the reduction amounted to 23.3 per cent; from an early average of 46.3 liters it was lowered to 35.5 liters in the late training period.

Within from four to six weeks after training was discontinued, the minute-volume of breathing during work was nearly back to the pre-training level. Thus, for the younger of our subjects, with a load of 6000 ft. lbs., the breathing for the early, late, and post-training periods averaged 39.2, 34.6, and 39.4 liters respectively; and with a load of 8000 ft. lbs., 56.5, 46.9, and 52.8 liters respectively.

The change in the percentage of oxygen of the expired air. Since the volume of air breathed per minute during work is decreased as the result of daily physical exercise, it is but natural to expect the percentage content of carbon dioxide in the exhaled air to be increased and that of oxygen to be decreased. The trained man absorbs a greater proportion of the oxygen from the air he breathes than does the untrained man. This means that he breathes more economically.

Both of our subjects developed, as a result of training, an increased capacity for absorbing oxygen from the air breathed. The extent of the change being most conspicuous when heavy loads of work were carried. Thus for the older of our subjects the average percentage of oxygen absorbed, with a load of 4000 ft. lbs., was 4.10 during early training, 4.66 during late training, and 4.43 in the post-training period; with a load of 6000 ft. lbs., it was 4.81 during the early, 5.29 during the late, and 4.76 in the after-training period; and, with a load of 7000 ft. lbs., it was 4.52 during the early, 5.36 during the late, and 4.16 in the after-training period.

It was observed that when the load carried was an over-load the percentage of oxygen absorbed was less than it was when the same load became a normal-load. Thus, at first, when the above man was out of training, loads of 6000 and 7000 ft. lbs. were over-loads. When he was out of training the percentage of oxygen in his exhaled air averaged, with a load of 4000 ft. lbs., 4.10; while with loads of 6000 and 7000 ft. lbs. it averaged only 3.91 and 3.73 respectively. During training, when the last two loads had come to be normal and crest-loads, the percentage of oxygen absorbed was raised to 4.99 and 5.17 respectively.

The time required to gain this increased ability of oxygen absorption was in the neighborhood of from 4 to 5 weeks. Soon after regular physical exercise was given up there was a reversion to the pre-training condition.

The quantity of oxygen absorbed. Ordinarily the per minute consumption of oxygen by the body varies almost directly with the work done. This linear relationship between the increase in load and oxygen absorption is shown in the following case, in which the subject of the experiment successively did 2000, 4000 and 6000 foot pounds of work. His consumption of oxygen when he was sitting quietly was 261 cc.; with a load of 2000 ft. lbs. it was 829 cc.; with 4000 ft. lbs., 1355 cc.; and with 6000 ft. lbs., 1891 cc. The increase in the usage of oxygen for these three equal steps upward in the load of work was 568, 526, and 536 cc. respectively.

While it is rather well established that the trained man can perform a given amount of work with a smaller consumption of oxygen than the untrained man, we only observed a reduction in the usage of oxygen in one of our subjects, and in that case it was slight. This was seen in the younger man. Training did not affect the amount of oxygen absorbed by him when he carried a load of 4000 ft. lbs.; but with a load of 6000 ft. lbs. it reduced the usage from 2.10 to 1.90 liters, and with a load of 8000 ft. lbs., from 2.69 to 2.44 liters.

The amount of oxygen consumed by the older of our subjects was also unaffected by training with the moderate load of 4000 ft. lbs.; but with a load of 6000 ft. lbs., his consumption of oxygen per minute rose from an early training average of 1.76 to 1.95 liters in the late training period; with a load of 7000 ft. lbs., it rose from 1.88 in the early training period to 2.15 liters in the late training period. This unexpected increase in the usage of oxygen by this man may have been the result of an improvement in the circulation of the blood. For him, prior to training, loads of 6000 and 7000 ft. lbs. were distinctly over-loads; while later, as a result of regular exercise, they came to be a normal-load and crest-load respectively.

It seems probable that a further study of cases will show that an increase in the usage of oxygen frequently occurs during training when loads that prior to training have been over-loads are, by the adaptive processes, accepted as normal-loads. According to the modern theory of the phenomenon of muscle contraction, lactic acid is set free in the contraction process and then again reconverted into a lactic acid precursor, glycogen, by an oxidative process. If, therefore, the reconversion of lactic acid into its precursor should become more adequate as the result of training, then, for loads of work in which this happens, an increased usage of oxygen would also occur.

The basal metabolism. The rate of basal metabolism has recently been brought into prominence as a factor of clinical value. It has been found

that the basal metabolism, or the amount of energy expended by the body at rest, is remarkably constant in the same person from day to day; although it may vary over longer periods of time with the conditions of life. While in reality the heat production in the body is the measure of basal metabolism, actually the metabolic rate is calculated from the oxygen consumed and the carbon dioxide expired. Determinations are ordinarily made in the morning, 14 to 16 hours after the last meal, while the individual is at rest in the recumbent position.

Heretofore observations on the influence of physical training on the basal metabolism have chiefly consisted of comparisons of trained with untrained men of about the same weight and height. The results from such studies have not been concordant, but the general conclusion seems to have been that athletes have a somewhat higher metabolism, both per kilogram of body weight and per square meter of body surface, than do non-athletes.

The moderate amount of exercise taken daily by our subjects caused a slight decline in the basal metabolism of one, but no definite change in the other. A summary of the data for both men is tabulated in table 1.

The decline in the basal metabolic rate was observed in the older of our two subjects. His average oxygen consumption per minute for the early morning determination, when not training, was 221 cc.; and when training, only 208 cc. The calories of heat eliminated per square meter of body surface showed a similar decline, falling from an out-of-training average of 36.8 to an in-training average of 34.3. According to the usual manner of statement, his normal basal metabolic rate was –4.9 per cent, while during the training period it averaged –10.5 per cent.

The full effect of regular exercise on the basal metabolism of this subject seemed to be reached in about three weeks. The calories of heat per square meter of body surface for the first three weeks of training were 35.5, 36.5, and 34.4 respectively.

It was impossible to follow in detail the changes after training was discontinued, because of the fact that this subject spent two weeks in a hospital for an appendectomy. From four basal metabolism observations made during six weeks thereafter it was found that the calories per square meter of body surface were 36.0, 36.1, 34.6, and 37 respectively; and the basal metabolic rates –6.2, –6.2, –6.0, and –3.8 per cent respectively. It is evident from these data that the effect of a period of two months of regular vigorous exercise on the basal metabolic rate is not lasting. It appears, however, that the basal metabolism of the body did not wholly return to the pre-training normal until about the end of the third month of sedentary life.

The observations made on our younger subject are summarized in table 1. His per minute oxygen consumption averaged 231 cc. when he was out of condition and 227 cc. during the training period. The average calories per square meter of body surface were 39.3 when he was out

TABLE I
AVERAGES OF THE BASAL METABOLISM OBSERVATIONS

	Minute-volume of breathing in liters	Carbon dioxide exhaled, in cc. per minute	Oxygen absorbed, in cc. per minute	Respiratory Quotient	Calories per square meter per hour	Basal metabolic rate in per cent
G. C. R.						
Out of Training	5.43	201	231	0.870	39.3	-0.4
Training	5.78	198	227	0.865	38.7	-2.0
E. C. S.						
Out of Training	5.04	187	221	0.822	36.8	-4.9
Training	4.60	177	208	0.851	34.3	-10.5

of training and 38.7 when in training, while the basal metabolic rate for the two conditions averaged –0.4 and –2.0 respectively. In the post-training period, when he took no exercise whatever and was so overworked that he was constantly fatigued, his metabolism still remained the same. A set of four determinations made the fourth month after he had trained gave an average of 38.8 calories of heat per square meter of body surface and a basal metabolic rate of –1.5 per cent.

From the above data it appears that a period of moderate physical training may or may not influence the basal metabolism, but that if it does do so there will be a decline in the basal metabolic rate.

From the data on basal metabolism it was possible to determine whether physical training modified the frequency and volume of breathing of the basal condition. According to our records the basal rate of breathing is not affected by moderate training. The average frequency of breathing for our subjects when in and out of training was as follows: For the younger man 17.9 and 16.5, and for the older man 9.2 and 9.6 breaths per minute.

The basal minute-volume of breathing was not clearly altered. The older subject showed a slight change. In the pre-training period he averaged 4.78 liters per minute; during training, 4.60 liters; and in the post-training period, 5.30 liters. It seems evident that moderate training did not decrease the volume of breathing, as the averages for the pre-training and training periods are as nearly equal as could be expected.

The data gathered in this investigation of the effects of training show that moderate physical exercise, about an hour daily, increases the load-carrying ability within one week, but that from five to seven weeks are required to bring out the full effect. They also show that any let down in the regularity or amount of daily work soon reduces the load-carrying ability, but that even with the complete neglect of exercise some of the gain is maintained for several months.

The amount of the increase in the size of the crest-load is determined by the physical condition of the subject prior to training. It was increased only 50 per cent in our subject who was in fair condition, and as much as 250 per cent in the subject who was in poor condition at the beginning of the experiment.

Outstanding among the respiratory changes is the fact that far less air is breathed by the worker in the performance of any laborious feat when in training than when out of condition, and that with this change there is developed an increased ability to absorb oxygen from the air breathed. This adaptation is found to occur with normal and crest-loads, but is most marked in those instances in which by training an over-load becomes a normal-load.

While the total amount of oxygen absorbed during a period of activity may by training be lessened for normal-loads, because of increased efficiency with which muscles work, yet it seems that with the changing of a given load from the position of an over-load to that of a normal-load an increased usage of oxygen may occur with that load.

It also appears that moderate regular exercise either slightly retards or has no influence on the basal metabolic rates.

Polyrhythmic Gymnastics

By Emil Rath
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I

"Im Anfang war der Rhythmus" (In the beginning there was rhythm) is a statement accredited to the great musician, Hans von Bulow. Rhythm has been with us as an eternal riddle ever since. Philosophers have endeavored to fathom its origin, its nature, and its significance, and have arrived at various conclusions. From ancient to modern times, they have interpreted rhythm as continuity, a universal principle, as the persistence of force, the formative principle of art, as characteristic of all motion, as opposed to meter, and in many other relations. Since rhythm is the very essence of polyrhythmics or polyrhythmic gymnastics, it behooves us to get a clear understanding of it, at least to the extent that the present existing knowledge concerning it will permit. Before doing this, however, let us for a moment return to the title of this paper.

Polyrthythmic gymnastics (poly meaning *many,* therefore many kinds of rhythmic gymnastics) involves rhythm in various forms of manifestation. It is concerned not only with the rhythm of bodily movements but also with that of singing and speaking in combination with bodily movements. The old German Lieder Reigen which were strangled by complexity of structure are one form of such a combination. They are a progressive continuation of our song games and offer to girls of elementary and high school age opportunities for expression in rhythm. They have the added charm of being composed of music, verse, and motion. However, if simplicity of movement is not retained, there is the danger of making them a mental activity predominantly.

The speaking chorus is an integration of poetry with physical, emotional, and dramatic gestures. According to the knowledge of the writer, it is new in America, although taught in many cities of Germany and Russia. It seems to possess great dramatic possibilities which may possibly be tied up with physical education work. Chorus work employs speaking rhythm with dramatic gesture predominating, but bodily rhythms frequently accompany the poetry.

Another venture along this line is being tried by Vachel Lindsay. He is endeavoring to have some of his poetry, suitable for the purpose, danced by a class while a reader recites it.

These last named types of rhythmic expression are particularly suitable for girls and women. There is a tendency to go to extremes in striving for novel and artistic effects and danger of losing the kernel and re-

taining only the shell. One might ask, "Should poetry be danced at all?" Does this not interfere with comprehending the thoughts of beauty and truth expressed and leave only its rhythm?

These different rhythmic activities constitute a worthwhile group in physical education. In this article we shall, however, confine ourselves to the discussion of the rhythm of bodily activities and only to such as interest boys and youths. An understanding of the nature of rhythm will enable us to better distinguish rhythmic from non-rhythmic movements.

II.

The literature on rhythm is principally of a philosophical nature. Science has not yet directed its penetrating and analyzing vision toward rhythm in human nature. The writer, at least, has no knowledge of any such scientific studies. On the other hand, every book on physics contains descriptions of this phenomenon pertaining to the physical world.

The ancient Greeks placed considerable value upon rhythm, as is evidenced by the prominent place of gymnastics in their education. Plato thinks rhythm is a part of human nature granted to man by the gods. Aristotle distinguishes three forms of rhythm[1]. 1. Rhythm of structures, which is also noticeable in the movements of the dance. 2. Rhythm of tone which appears in song combined with harmony. 3. Rhythm of speech whose elements are meter. Although rhythm of musical harmony was highly appreciated because of its influence on the soul, rhythm of bodily movement was considered of equal value because of its expression of noble culture and moral self-discipline. Dancing accompanied by music and song was the consummate expression of rhythm and to them a religious act.

To the Greeks, rhythm is a principle that penetrates the universe. Lucian in his writing of the dance thinks of it as being created simultaneously with the ancient Orphic Eros who brought order out of chaos and started the "dance of the stars."[2]

In the Athenian Greek education beauty of body was as much sought after as beauty of mind. The plastic arts of the Greeks give us a consummate expression of body culture which history has recorded for us. These works speak of incomparable grace and naturalness of movement, of inexpressible nobility and of silent greatness. The three typical manifestations of the most beautiful specimens are examples of stepping, standing, and sitting human beings. They are Doryphoros, the Spear Carrier of Polycleitus dating from the fifth century, and Apoxyomenos, (Spigilis statue), and Hermes resting by Lysippus.

The beautiful in form is as inevitably an outcome of rhythmic training of the body as is the control of movement. It should be considered

[1] Sears, Chas. H., Studies in Rhythm, I, p. 22. Clark University, Worcester, Mass. Dissertation for Ph.D. degree.

[2] Bucher, Karl, "Arbeit und Rhythmus," Chapter 9, pages 415-417 (B. G. Teubner, Leipzig, 1909).

in a complete scheme of physical education. It was a long period of growth in perfection of structure that began with the uncouth dawnman, passed then to the Neanderthal and Cro Magnon type, and ultimately to the splendid specimen of human beings exemplified by the Greek civilization.

III.

Spencer considered rhythm sufficiently important to devote a chapter to it in his "First Principles".[3] He is of the opinion that all motion is rhythmical and that rhythm is a necessary characteristic of all motion. There are those who do not agree with these statements. They see in them a lack of understanding of meter, which is also a characteristic of motion. This will be considered later.

Spencer dwells at length upon the rhythm of the solar system, the earth and other planets, and the rhythm of atmospheric and meteorological changes. Life on earth is organized in undulations. There is rhythm in mental states, there is the flow of emotion in dancing, poetry, and music; even business moves in rhythmical waves.

We do indeed find this eternal flow of rhythmic motion manifesting itself everywhere. The universe goes on indefinitely in regulated movement. Planets and their satellites, celestial wanderers of the sky, continue their rhythmic pace in endless revolutions. The changing tide obeys the silvery moon that wanes and waxes in measured intervals. Everywhere in the universe the whirling orbs circle rhythmically.

On our mother earth the same principle holds sway, in living and in inanimate things. In the last analysis matter seems to be composed of miniature solar systems. We have progressed in our knowledge from mass and molecule to atom and electron. The movement present in the electron seems a replica of the rhythm that prevails in the solar system. Infinitesimal substances revolve about a nucleus in measured motion of incalculable speed. Rhythm pervades everything.

Life itself is but a manifestation of rhythm. When rhythm no longer permeates living beings, life ceases. One need not delve long in speculation as as to the source of life to discover how intimately it is interwoven with rhythm.

The human organism is an example of numerous systems of rhythms integrated into a living unit. Rhythm is found in parts of the cells composing the human body such as the moving of the cilia, in the cells themselves, in the tissues where many forms of movement take place, in order of time as well as in direction, in organs of the body and in systems of organs[4]. All the vital bodily functions operate at regular intervals. Governed by the autonomous nervous system, the pulse throbs in definite measure in response to the beating of the heart and inspiration and expira-

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[3] Spencer, Herbert, First Principles, Chapter X, pages 212-230. P. F. Collier and Son, New York.

[4] Shipley, Sir Arthur E., "Life," XII, pp. 133-159.

tion alternate rhythmically. Probably, all of this is but a phase of the cosmic rhythm governing the universe.

Not only internally but externally do living things show rhythm. This is also true of inanimate things. Consider the beautiful rhythmic lines one finds in the honey-comb and in the nests of the wasps; the flowing lines of shells, and the graceful lines of animals living in nature's environment.

Since all the physiological functions of living beings are rhythmic it is but logical to conclude that the outward manifestation of such inner actions will appear in the form of rhythmic movements.

Man therefore works preferably in rhythm. Bucher in his thorough study of the origin of work and rhythm[5] concludes that most work of primitive people was carried on in a rhythmic manner. Certain sounds always accompanied the rhythmic work. If the sound was not produced by the work itself, other means were used to provide it. The human voice was one of these means for rhythmic accompaniment of work. Even today there are certain calls associated with the work of sailors, boat crews, and others used to add rhythmic swing to their labor.

Primitive man used the most economical method, the method requiring the least exertion and the most favorable condition in which to do his work. This meant the use of rhythmic motion in a nude or semi-nude state[6].

Bucher finds that among primitive people work, play, and art were one. It was not then necessary to distinguish between work and play. From this trinity (work, play, art) of the primitive man there emerged dancing, music, poetry, and also the graphic and plastic arts. The bond that joined these different elements was rhythm, the order of movement in time by which work was done in a rhythmic way. The voice was used as a rhythmic help and the whole undertaking was frequently nothing but play to them.

The observation of Miss Glyn that each art has a rhythmic origin is thus substantiated by Bucher. In her opinion each art conforms to the rhythmic principle by consisting of a whole made up of variously related parts[8]. Only rhythmic succession of tones, not any haphazard succession, is music. Such a sequence of tones Miss Glyn calls the formative principle. It is this that makes unity out of parts, that adds organization, and by means of which it is possible to appeal to the soul and feeling of man. Musical works remain unintelligible until their rhythmic form is grasped.

IV.

In an article appearing in a collection made by Pallat and Hilker

[5] Bucher, Karl, Opus cited, Chap. III, pp. 38-56.

[6] Bucher, Karl, Opus cited, Chap. II, pp. 21-37; p. 19.

[7] Bucher, Karl, Opus cited, Chap. IX, pp. 413.

[8] Glyn, Margaret H., The Rhythmic Conception of Music, Chap. I, pp. 1-24.

entitled "Künstlerische Körperschule," Klages endeavors to fathom the meaning and nature of rhythm by metaphysical speculation[9].

He distinguishes clearly between rhythm and meter both in time and space and claims that many investigators were actually examining meter when they thought they were examining rhythm. "Rhythm and meter are by their nature different and opposed to each other". "Rhythm never depends on meter but meter always depends on rhythm." "Rhythm may appear in consummate form with complete absence of meter."

The beat which indicates meter denotes a beginning and ending of measures each of which is like its predecessor. Rhythm on the other hand is continuous. It is like the flow of movement as manifested in the ever increasing concentric circles of waves caused by an object falling into the water. There are no points to indicate the beginning and ending of each successive wave. Moreover, no wave is a model of its predecessor, just as no tree is a copy of the parent tree, no leaf identical with another. Nature is everlastingly re-creating itself, but never identically repeating itself.

When meter is combined with rhythm the result produced is the uninterrupted flow of movement spanning the measures. It is this spanning the measures that is decisive and not the meter itself although this may at times add strength to rhythm. Meter is produced by an act of the intellect which *divides* rhythm into parts while rhythm may be comparable to the stream of life which is continuous, that is "indivisible". Rhythm may be spatial as well as temporal. Spatial rhythms manifest themselves in the Greek border, architecture, drawings, writing, even in the structure of trees, and in the color distribution of an autumn leaf. But all spatial rhythm possesses the main features of rhythm in time and vice versa. Likewise there may be a lack of this rhythm of natural symmetry as when two posts mark the entrance to a field or garden. This is comparable to what is called "duple time", like the thumping beats of a machine which always appear to occur in doubles. Joining these two posts by an arch transforms the entrance into a rhythmic spatial appearance since it meets what Klages calls the first condition of a rhythm, namely, continuity. Now if the two halves of the arch resemble each other but are not identical the second condition of rhythmic requirement is met. Both these conditions are fulfilled in the varied symmetry of human forms.

In discussing the activities of the nature-people of today and of primitive times he says it is not exaggerated to say they dance their religious services, their festivals, culminate their quarrels by sarcastic songs, go dancing into combat and complete difficult tasks to the accompaniment of songs. Their lives seem to be attuned to and to undulate with the rhythmic flow of the forces of nature and life. Their festival dances which sometimes last whole nights are accompanied by song and various

[9] Pallat, Ludwig and Hilker Franz "Kunstlerische Korperschule," Chapter on "Vorn Wesen des Rhythmus" by Ludwig Klages, pp. 94-137. Pub. Ferd Hirt, Breslau, Germany.

noises, as clashing of weapons, beating of drums, cymbals, tambourines, gongs, castanets, etc. Rhythmic movement apparently needs some form of sound accompaniment. Movement and sound have within them the same dynamic forces.

It is extremely difficult to discover meter in primitive music and yet primitive people have no difficulty in singing together. Investigations made by the Berlin Psychological Institute proved that many melodies could not be analyzed into the meter used. They were contented to note a constant change of metrical groupings of almost incomprehensible range.

There is, of course, a significant value in meter. If rhythm is an expression of the process of life, of a universal force, a manifestation of the soul, as Klages puts it, then meter is manifestation of mind. Primitive man is not only carrier of a soul but also carrier of a mind, of an intellect. This dual manifestation is antagonistic. Meter may destroy rhythm but it may also serve it by proper arrangement. The claim that our highly intellectualized and mechanized civilization is no longer rhythmic would find its basis in this apparent overemphasis of meter and in its antagonism to rhythm. Proper pairing of the two, with meter serving rhythm, can resolve this antagonism.

In trying to find the cause of the enjoyment derived from rhythmic structures and performances Klages concludes that it is due to relieving the body of inhibitions. The amount of pleasure a natural or artistic configuration produces is equal to its content of rhythm. It matters not whether you consider the content from the point of view of one who creates rhythmic structures by dancing, singing, poetry, painting, sculpturing or by architecture, or from the point of view of one who only observes these structures. However, an observer, can enjoy rhythm only to the extent that he can free himself of repressions. A person will produce rhythm to the extent that his activities are carried by the rhythm impulse and freed of volition.

Klages thus brings out some important characteristics of rhythm; e. g. continuity or the non-metrical flow of movements; resemblance, but not identity, of repeated parts. Both of these are opposed to marked meter which causes a division in the rhythmic movement, and they are superior to regularly beaten time for the same reason that the oriental hand-made rug is more artistic than the machine made. May not the rising tide of d..ire for antiques, with their rhythmic characteristics, be but "symbols of revolt against the domination of the machine," as a recent writer put it? A further condition of rhythm is the elimination of inhibitions so that this vital principle may function freely. These characteristics should be present in rhythm activities, in the delivery of verse and song, and in the performance of bodily activities.

V.

When applying these characteristics to bodily movements we must be sure that the rhythmic activity consists of a tensing movement followed

by a non-tense phase as occurs in the rise and fall of the wave; that no motion is identical with its predecessor, and that the proper relaxation of non-active body parts accompany all action. Exercises in which flow of continuity is broken by pausing in positions and requiring volitional impulses for each change of position, and in which relaxation is absent, do not belong in the class of rhythmic activities.

Further, rhythm seems to be the element which adds unity and organization to whatever complex bodily activity with which it is associated. We recognize a rhythmic act as a finely coordinated performance. Its opposite, a metrical performance, tends to destroy this unity. This is acutely felt by people who have retained their natural feeling of rhythm or who have regained this sensitivity to the rhythmic impulse. Moreover, limiting a rhythmic activity to certain body parts inevitably interferes with the rhythmic unity of the whole. It inhibits movements that would otherwise take place through sympathetic action. It sets up inhibiting forces which break the continuity of the rhythmic impulse. Movements of parts should therefore receive emphasis only in relation to the body as the whole, which is swinging rhythmically at the same time though in a lesser degree. Thus, any organized bodily activity truly rhythmic in nature would be a manifestation of harmonious motion of the entire being; or if any of its parts, of those parts in relation to the whole.

It is therefore desirable to apply the principle of totality of movement to all rhythmic activities. When body parts are active, their movements must begin at or near the center of gravity and flow outward. This involves, though in a lesser degree, the entire organism. Static contractions which fix parts in definite positions are therefore undesirable in the purely rhythmic type of movements.

Bode arrives at these principles and others from a consideration of bodily movements in relation to instrumental music[10]. He bases his conclusions on the form of movements of natural organisms. To him these living beings are the incarnation of complete unrepressed expression of the life force. He asserts that the present tendencies in education develop strains in the pupils and do not offer sufficient opportunities for self-expression. Only a few leaders, disciples of progressive education, endeavor to re-establish the balance that should exist between two fundamental groups of school activities; a group demanding lawful and willful obedience and a group admitting of spontaneous, apparently ungoverned action; i. e., self-expression. The latter is an expression of the human soul, much thwarted in our present civilization. Bode observes that animals move in perfect grace because theirs is a life of spontaneity. Their movements suggest correct balance of force and relaxation, of interplay of muscles, of manifestation of rhythmic flow of movement and of the movement beginning at the center of gravity and following the lines of least re-

[10] Bode, Rudolf, Rhythmus and Korpererziehung. Chapter: Musik und Korpererziehung, pp. 51-62. Published by Eugen Diederichs, Jena, 1925.

sistance. Students of instrumental music particularly should be trained in gymnastics based on these principles so as to acquire "the power to physically express spiritual impulses". Non-rhythmic musical expression, like metronomic instrumental practice, is soulless, expressionless, lifeless. Dalcroze[11] endeavored to overcome this by teaching his pupils a system of rhythmic bodily activities entitled "Eurhythmics" which, however, are more metrical in nature than rhythmical. They have never become popular, perhaps because of this. On the other hand, simple rhythmic movements have always found favor in education. Musicians feel the need of rhythmic bodily control as essential for a genuinely satisfying expression of their real selves when interpreting composers.

Summarizing the various points brought out in this discussion pertaining to rhythm we find its source an all pervading force present in the entire cosmic realm; that it exists in all things animate and inanimate; that only the human being seems conscious of it, and then only in part, for normally he is unaware of his circulation, respiration, and many other rhythmic physiological functions; that it is that part of us which is akin to the life-force; that it is opposed to a governing intellect and acts as a balance wheel toward it, and is in harmony with spontaneity and abandon; that it is non-metrical and non-mechanistic and therefore antagonistic to this machine age which seems to suppress and destroy it; that it is a unifying principle of all arts and of mankind linking everything in the universe and engulfing it in a cosmic rhythm. It is manifested in bodily movement in proportion to the extent inhibitions can be diminished or removed; moreover, it may be intensified by training in certain bodily controls based on principles inherent in it and growing out of the study of it; as, continuity of movement; non-identity of repeated movements, alternation of tense and non-tense or relaxed movement, undoing physical inhibitions by removing excessive muscle tone and avoiding static contractions, resolving internal strains, using movements of the organism as a whole and of its parts but only in relation to the whole; activity beginning at center of gravity; movement along line of least action.

VI.

These principles will now be considered more in detail and then applied to the teaching process and to the selection of material intended for boys from 6 to 18 years of age. We have found that this work is also suitable for girls who seem to enjoy it as much as boys. The wealth of material is almost unlimited and may be found in activities in which children are interested. This kind of work, gives to boys much the same pleasure that dancing gives to girls.

1. Continuity of Movement. Rhythmic bodily activities should involve a minimum of volitional power, diminishing the application of the will as much as possible. After the first impulse is spent, the movement continues by a series of stimuli and

[11] Jacques—Dalcroze Emile, Rhythm, Music and Education, G. P. Putnams Sons, New York, 1921.

responses produced within the organism. That is, it tends to become automatic. This is observed in ordinary movements of locomotion and in body swings. If progression and selection of activities is correctly observed the automatic characteristic can always be maintained. Continuity is further maintained by such forces as inertia and momentum and the elasticity of tissues. If, however, there are any obstructions to hinder the freedom of action, the harmonious rhythmic interplay of bodily parts is interfered with and destroyed entirely or in part depending upon the degrees of restriction. Perfect flow of rhythmic movement is possible only in a perfectly functioning motor mechanism.

2. Non-Identity of Movement. Activities rhythmically performed can only resemble each other but will never be identical. No dance step is the exact reproduction of its predecessor nor is a simple body swing identical with the one preceding. Nor can one individual precisely reproduce the performance of another. It is in this dissimilarity that persons stand out as individualities when performing rhythmic activities. On the other hand, movements that end in static positions, and require volitional impulses for each change, lack this free expression of self. In fact, instructors teaching this type of halting exercises insist upon uniformity and precision in execution to such extent that individual expression is lost. The rhythmic flow of movement is, of course, not present. These movements must therefore be placed in the category of metrical rather than rhythmic movements.

3. Totality Movements. We have observed from the preceding discussion that all bodies moved by rhythmic impulses move as a whole, therefore, a further characteristic of polymotor rhythmics is that they are an expression of the body as a whole rather than of its parts. The movement of the body as a unity is identical with the movement forms of the lower animals. When parts are rhythmically active it is in their relation to the body as a whole that this activity should take place. This principle is of no concern when movements are intended to be unrhythmic, or when applied to abnormal conditions as in corrective work.

4. The Center of Gravity in Relation to Movement. In order that the preceding principle be complied with it is essential that all movements begin at or near the center of gravity and move out from that point. In stationary work the point of attack will depend upon the position assumed, that is, whether standing, kneeling, sitting, or lying. In locomotor activities the attack of the impulse must likewise be at the center of gravity otherwise distorted performances result such as one may see in walking, where the center of gravity is either too far behind or too far in advance of the point of support.

5. Economy and Direction of Movement. This is a principle underlying all activity in nature, animate or inanimate. A good example in the physical world is the law of gravity, illustrating clearly this principle of direction and economy of movement. In living things it is manifested in the desire for quick adjustment to each new situation. Therefore, all movements should take place along the line of least action and always in relation to a definite goal. It is not always easy to discover the amount of movement involved in performing a definite task with the least amount of action. If the body is to move as a unit, every action of its various parts must contribute to this movement and not hinder it in achieving its goal. Williams has called this the "energy-activity ratio" principle.[12]

6. Contraction and Relaxation in Movement. In inanimate nature tenseness and rest in motion is beautifully illustrated by the rise and fall of the wave. The crest is the summit and terminating point of tenseness. The receding of the wave and the trough present the phase of relaxation. In animals contraction and relaxation flow through the movements of the entire body when in action. In all rhythmic movements of the human body there should also be the alternation of these phases of muscular action and at proper rhythmic intervals.

[12] Williams, Dr. J. F., Principles of Physical Education, VIII, p. 325. W. B. Saunders Co., Philadelphia, 1927.

The foregoing fundamentals deal with those characteristics of movements that are essential to make movements suitable for rhythmic development of pupils. There is one principle, that must be mentioned, which concerns the needs of growing children: the selecting of material for its biological significance, and its adaptation to the age and maturity of the boys. The work must be vigorous enough to affect circulation, respiration and the neuro-musclar system in a marked manner if worthwhile results affecting growth and development are to be obtained. Mild exercises should be few and used as intermediate movements between the more vigorous exercises which should predominate in the work.

VII.

Rhythm, as such, cannot be taught. If it is the universal principle that our discussion would lead us to conclude, then cultivating rhythm will be more a matter of producing a spiritual and bodily state that will enable rhythm to manifest itself, than a procedure of teaching it. We can intensify the rhythmic tendency by procuring for it a condition allowing of the greatest freedom: an organism liberated of repressions; and we can awaken it by making of the body "a responsive instrument of expression". In doing so we sensitize the human organism and diminish the effect of inhibitions to such an extent that its responsiveness to stimuli, external and internal, will be greatly increased. We may do this by the selection of the right kind of bodily movements and by a correct procedure in presentation.

It is commonly observed that all children do not have the same appreciation of rhythm and that individuals vary in ability to receive and ability to express rhythm. Power to perceive and reproduce may be improved by cultivation[13]. Children failing to march or sing in time with others will be few, if any, when rhythmic instruction is given.

Teaching procedure finds its basis in the above facts. Presentation should be by means of the whole method. Analysis of a complex activity into elemental parts will not be necessary if the selection and presentation has been progressive and adapted to the insight of the children. The three steps of presentation may be used: first, explanation and demonstration; second, trial and criticism, the criticism practiced by instructor and pupil; and third, drill and suggestion, principally for enjoyment. In the second step the instructor diagnoses the performance with reference to the principles pertaining to rhythmic form previously mentioned so that he may aid pupils in making it automatic. He asks himself, "Are the movements flowing, continuous? Are the contractions rhythmic, that is, is there alternation of rest and tenseness? Does the body move as a unit or do the arms and legs move as if detached? Further, is the flow of movement from the center of gravity? Is economy of movement practiced? Are parts not active properly relaxed? And finally, are any of the move-

[13] Sears, Charles H., Studies in Rhythm, p. 18, 19; 24.

ments interfered with by inhibitory conditions existing in the body?" Pupils are urged to make similar observations. Criticisms are then given accordingly. At the same time the teacher will gradually sense the rhythm of the group, each pupil of which has been working in his own rhythm until now, and accompany it by his tambourine, a gong, or tom-tom, or by an adapted method of rhythmic counting for the third step. The tambourine is most suitable as an instrument to accompany rhythmic movement.

By this time, the activity has become automatic, or nearly so, and the body has improved in rhythmic expression. It should be possible to see this in the freedom of movement, in its apparently spontaneous nature, and in the joy it awakens and expresses. As these results occur oftener in the locomotor work than in the stationary work, it should receive more attention.

During this practice expression of individuality has free play. Polyrhythmic activities are well suited for this because it is impossible to prescribe accurately the form of their movements.

If a pianist is to accompany the work he must be trained to fit his playing to the activities. It should not be a case of pupils following the music, but vice versa. Music adds an emotional drive to the work and increases its enjoyment. It is difficult to secure a musician trained for this. He must be versatile and quick at improvising in order to find musical patterns suitable to the work in hand. He must be as rhythmic and spontaneous in his playing as the pupils are in their activities. Out of the work with boys and youths only simple patterns evolve and it is therefore not difficult to follow the work. Occasionally the instructor should indicate an original rhythmic pattern as a problem for the pupils to solve. Such patterns may also be selected from compositions or musical motifs.

VIII.

The activities may be classified into locomotor, stationary and semi-stationary. There are a number of groups in each class, some of which should be included in every instruction period. A small number of exercises from each group will be given to serve as a suggestion. Actual selection of suitable work will grow out of practice and from observing the children and learning their needs and desires.

Locomotor activities are primarily problems in controlling the center of gravity of the body and in adjusting its movement to the surrounding space. They consist of skipping, galloping, hopping, running, leaping, jumping, and walking, all of which may be modified in an endless manner by adding turns, changing direction, adding floor patterns on which they are to be performed, by spatial adjustment which consists of covering certain distances in various directions by a definite number of movements, and by alternating and combining the activities.

The formation most suitable for this work might be termed a "free

formation" in which half of the class stands at each end of a rectangular space generally used for this work. The activities should be practiced preferably outdoors on a rectangular grassy plot and during inclement weather in the gymnasium. From the position described, with one-half of the class at each end of the rectangular space, count off in two's or three's, or more, depending upon the size of the class. Each number takes his turn in moving across the space to the opposite side while performing an indicated activity.

The semi-circle is another formation suitable for this work. In this formation the pupils move, one number at a time, in a circle, with the other members of the class forming a background. They pass in front of their class-mates and finish where they began. Because of the nature of these activities they soon become automatic. The rapid adjustments the pupil is compelled to make in all these activities give him excellent control of his body and prepare him to better participate in the after school activities and to cope more successfully with outdoor conditions.

Skipping and Galloping.

Generally these two activities have been mastered by the time boys and girls enter school. Occasionally children are found who have been prevented by accident or illness from acquiring these action-patterns. Such usually progress rapidly if they are normal.

Beginning with these known steps, the instructor can proceed as outlined below. There should be much freedom of movement and buoyancy in these steps. As the pupils progress to more interesting forms in these steps, the instructor should strive to retain that joyous spontaneity and abandon associated with activities that children bring to school. The automatic flow of movement and improved rhythmic control are also essentials. Internal and external inhibitions which begin to appear with the beginning of school life can be combated by following free movements.

Main Activity—The normal skip step forward, sideward left, sideward right, backward (directions adapted to the age group); the skip step on ball of the foot; on toes; on ball-toe; on sole of the foot; on heel-ball; on toe-ball; any of the above with the feet turned inward; feet turned outward. Alternations, etc., etc.

Complimentary Activities—With natural arm swings; with open and closed swing; with horizontal arm positions in one line or at angles; other arm movement that will aid the execution; with foot swings and knee swings adapted to the short, long, and high skip movement; with suitable trunk movements. Hints on breathing.

Spatial Rhythm and Adjustments—On forward-backward lines; on lateral lines; on zig-zag and serpentine lines; or circular and semi-circular lines; with steps adapted to definite distances, etc., etc.

Some of these movements will give rise to funny and grotesque performances and all should give rise to the feeling of joy. The gallop-step may be treated in the same manner. The flying gallop, in which the gallop movement is performed in the air, should be used alternately with the regular step.

Hopping.

Every boy and girl can hop at six years of age. Usually the keen lad of six has by this time invented several tricks in hopping.

The circulation and respiration are markedly increased during hopping, and knowledge of this should determine the amount of hopping to be given in a period. Movements of the free leg and the arms should be coordinated with the hopping movement. It is best to progress slowly so that hopping will retain its natural, automatic form of execution. The distances to be hopped on one foot may be gradually increased.

Main Activity—Many hops on one foot in all directions with various foot activities as in the skip step; the single, double, and triple hop in all directions; many hops with clicking; with jumping over the free foot; hopping with turns and exercise of the free leg.

Complimentary Activities—With natural arm swings; with horizontal positions of the arms that will assist in the hopping; with suitable trunk movements; combinations. See the skip step. Hints on breathing.

Spatial Rhythm and Adjustments—Adapting definite number of hops on one foot to definite distances; vary the size of the hops as short, long, and high hops; see the skip step for floor patterns.

Running.

Much teaching of form in running is necessary in order to eliminate wrong and restricting movements. Running offers opportunities for variations of a wide range that add interest and pleasure to the work. Because of its automatic nature it can readily be combined with many other activities.

Main Activity—The normal (usual) running step in all directions; sprint step; the endurance step; the normal step with foot exercises as in the skip step; in groups of two, three or more; with hands joined; combinations.

Complimentary Activities—With natural arm swings; with correct movements of shoulder and pelvis; with horizontal arm positions suitable to the direction of the run; with foot swings; knee swings, and leg swings. Hints on breathing.

Spatial Rhythm and Adjustments—On various lines as in the skip step; the spiral; varying the size of the steps and adapting them to certain distances; running on original patterns. Practice running on a straight line.

Leaping.

Leaping resembles running, and what was said about it applies here. Its effect upon the circulation and respiration is much stronger, however. This should be considered when using it in a lesson.

Main Activity—The normal (or usual) leap in all directions; the broad leap; the short high leap; the broad high leap; the hurdle leap; combinations with other locomotor activities.

Complimentary Activities—With the natural arm swing; horizontal arm positions for change in directions; correct movements of shoulders and pelvis. Hints on breathing.

Spatial Rhythm and Adjustments—The same as in the running step.

Jumping.

This is as vigorous an activity when performed continuously as hopping and leaping. Difficulty is always experienced when trying to coordinate arm movements with continuous jumping, but this must be achieved before proceeding to variations or combinations of this group.

Main Activity—Continuous standing broad jumps half-way across the space or all the way across; the same in fewer jumps; continuous standing broad jumps in various directions. Combinations as the three step jump; the step jump; the jump step; two step jump, etc., etc. Other combinations.

Complimentary Activities—Arm and trunk movements that assist in various jump forms; adding turns; adding leg exercises and trunk bendings while in the air. Hints on breathing.

Spatial Rhythm and Adjustments—On straight lines; adjust the jumps to certain distances; on diagonal lines.

Walking.

This has been placed last among the locomotor activities, but not because it is of least importance. Polyrhythmics should not be started with the teaching of walking, however. Children should be given the buoyant happy activities at the outset and then led gradually to appreciate the significance of this ordinary but important exercise.

Instruction in walking should be given before or after the more vigorous locomotor exercises and always performed in such a way that every pupil will be mentally and physically active; mentally, by observing and criticising, physically by trying it out.

Some of the common faults prevailing are the following:

Toeing outward instead of straight forward.

The lumbering gait caused by walking with feet apart.

Moving by action of the lower leg and little action of the hip joint —very common in the walk of young women.

Stiffness in the pelvis or, it is probably better to say, in the hip joint and spine, which prevents rotation of the pelvis and consequently shortens the stride. One finds this frequently in tall people and in those of average size. On the other hand, short people have been compelled to use this rotation of the pelvis to increase the length of their stride so as to keep abreast with taller friends when walking.

An unnecessary stiffness in the spine, particularly in the dorsal and cervical region, which interferes with the rhythmic body swing intimately interwoven with good walking.

The arm swing, which frequently is limited to a short, jerky motion of the forearm instead of the pendulum motion of the entire arm with slight movement of the shoulders added.

Permitting the center of gravity to be too far in advance of the point of support or too far behind it.

All these elements enter into correct walking and are of first importance since walking is an activity used daily. Instruction in walking

correctly should therefore be included in every lesson. In fact, it is desirable to repeat the same instructions yearly so that how to walk correctly is firmly impressed and eventually becomes a habit.

Main Activity—The normal step in all directions; with various exercises of the foot as walking on the ball; toes; heels; sole; outer edge; ball-toe; heel-ball; etc., etc. These exercises should be given frequently and progressively to develop muscular strength of the foot. Combinations with other activities.

Complimentary Activities—With natural arm swing; with horizontal position of the arms, in line, parallel, and at angles to assist the walking movement; correct shoulder and pelvic movements; turns. Hints on breathing.

Spatial Rhythm and Adjustments—On lines similar to those used in the skip step and other activities; shortening and lengthening strides adapting them to space; using original patterns.

IX

The stationary and semi-stationary activities are principally concerned with transfers of weight, which involve rhythmically coordinated responses of a multi-motor variety, building up many activity patterns in the neuromuscular mechanism; and with teaching an understanding of directions in relation to the individual.

None of the activities are performed entirely with the pupil standing in one place. They all involve movement radiating in all directions from this spot but usually bring the pupil back to his starting point. Activities of this class are best taught in an open order formation and should become automatic if selections are properly graded and presented.

Pupils must be encouraged to observe constantly and offer criticisms to their class-mates. To do this one file rests while the other works. When both files rest opinions are exchanged.

The activities may be grouped into the following classes: Activities of Opposition, Studies in Direction, Relaxing and Suppling Activities, Weight Transferring Activities, Balancing Activities, Mimetic Activities, Activities for the Control of Center of Gravity, and Rhythmic Body Swings. A few examples of each group are given.

Activities of Opposition.

This group of activities is given to stamp firmly into the neuromuscular mechanism the habit of opposition in movement. Beginning with simple automatic movements, progression leads to tricky and frequently artistic movements requiring considerable skill and which are much enjoyed by the pupils.

Main Activity—In small stride stands; arm swings in various directions with emphasis on opposition; change the stride stand by stepping with one foot; these movements progress by gradually building up the oppositional movements until the entire body is involved and a vigorous swing of legs and arms is obtained.

Complimentary Activities—All parts must contribute to the movements; varying movement by foot placing forward and backward or sideward and inward; the half balance stand with leg kicking backward and oppositional arm swings; stepping and leaping forward and backward two, three and more steps or leaps with correct movements of opposition. Trunk movements in opposition to movements of legs or arms. Hints on breathing.

It is obvious that in all movements from place the same principles are applied. The activities here given are stationary excepting the steps and leaps forward and backward and the balance stand with leg kicking, which may lead to movements forward, sideward, and backword.

Studies in Direction.

These activities are to lay a foundation for the pupil's understanding of his relation to the environment in regard to direction. It might be added that a thorough knowledge of directions gives to the body more avenues of expression by movement and therefore greater freedom of action.

Main Activity—The arm exercises used consist of raising, swinging, pushing, pulling, thrusting and striking as rebounding movements, etc. in rhythmic execution. They are performed in all directions. The arms may be parallel or in a line, in which case they move in opposite directions. Foot movements selected from the studies of weight transference may also be used to acquire the sense of direction.

Complimentary Activities—The entire body must adapt itself to the movements in various directions and make the performance a well coordinated one. Hints on breathing.

Relaxing Activities.

Relaxation is a phase of every correctly performed rhythmic movement. It must, however, be practiced as a special activity so that the entire body can be completely relaxed at will. This can be acquired through practice and therefore should be taught. Much of this kind of work must be done when polymotor rhythmics are started, for many persons have lost the ability to relax at will.

There are often present in the body two conditions that prevent complete relaxation. These are: (1) certain strains that act as inhibitions, and (2) certain physical conditions such as shortened muscles and ligaments and excessive muscle tonus.

Short and long swinging movements are frequently used to stretch shortened and tight body tissues. Only movements that serve definite ends should be selected. Relaxing movements will diminish or remove the muscle tonus and also help in reducing inner tensions. The rhythmic body swings contained in Bode's "Expressional Gymnastics"[14] are essential primarily for the development of rhythmic power, but they also possess elements valuable for relaxation purposes. That this power of relaxation is markedly absent in the average man and woman of our times can be easily observed.

This is not true of trained athletes, for they usually learn the need of the proper interplay of tense and non-tense phases of action. Watch the swimmer as he lifts his limp, completely relaxed arm out of the water in the crawl stroke; the runner's lower leg as it swings forward for another stride; the dancer as she alternates tense with soft movements. Watch the fine apparatus performer or tumbler who uses the free form, not the

[14] Bode, Rudolf, Ausdrucks Gymnastik, C. H. Beck, Munchen, 1925.

rigid artificial form, in execution, and notice how the parts of the body not active in the stunt relax; watch any person who possesses rhythmic control and you will discover in his action the free, unhindered flow of movement alternating in relaxation and contraction of muscles.

In polymotor rhythmics, therefore, ability to relax is a matter worthy of attention; tenseness is removed and the body is restored to balanced rhythmic interaction among all its parts. It is to be observed further in teaching that by far the largest number of movements begin from a relaxed condition of the muscles, proceed by means of complete contraction and resolve themselves again into a relaxed muscular state. Fast movements, however, vary from this by starting from a condition of muscle balance, a readiness for action, in which the two opposing muscle groups are in a state of preparedness.* [15] [16] [17]

Main Activity—Beginning with developing ability to relax the head, shoulders, arms, trunks, legs, proceed to combine movements. Use a rebound to maintain a rhythmic swing in the performance. The Danish exercises, as well as the Bode rhythmic swings, may be used to stretch tight ligaments and muscles. Practice shaking body parts.

Complimentary Activities—Definite positions must be assumed so that the body as a whole is participating even when emphasis is placed on parts. When beginning polyrhythmics much time should be devoted to relaxation. Material may be selected from the references given below, (18), (19), (20).

Weight Transferring Activities.

The principle involved here is the same as that in locomotor work; that is, a shifting of the body to make quick adjustment. Here we are concerned with shifting the body about a point or in a small space, as in the combative activities. The movements must increase in speed as well as in distance covered. Interesting activity-patterns and control of the body in quick transferences grow out of progressive procedure.

Main Activity—Begin with transference over small distances in the principal directions. Proceed to movements passing from one direction beyond the point of support to the opposite direction; increase the range of the movement so that the progression will be from the step to a lunge, to a fall-out, and deep lunge.

Complimentary Activities—The arm activities added must be helpful in the transference; likewise movements of the trunk and head. Add turns, progressing until complex activities are reached. Hints on breathing.

* The following three references give additional information on relaxation.

[15] Mulliner, M. D., Mary Rees Mechano-Therapy, VII, 103-114. On Relaxation and Neuro-Muscular Economy.

[16] Call, Amia Payson, Power through Repose, Little, Brown & Co., Boston. Contains splendid exercises which may be incorporated into the groups given here.

[17] Patrick, S. T. W., Psychology of Relaxation. Houghton, Mifflin Co., New York, 1915, Chapter on Play.

[18] Sumption, Dorothy, Fundamental Danish Gymnastics for Women, A. S. Barnes, New York, 1927. This contains the material Bukh taught to men and women and may be profitably used for boys.

[19] Bode, Rudolf, Ausdrucks Gymnastik, C. H. Beck, Munchen, 1925. This contains the rhythmic body swings and other forms of Bode's "Expressional Gymnastics."

[20] Rath, Emil, Open Order Work, Normal College, A. G. U., Indianapolis, Indiana. Contains suppling, stretching, strengthening and relaxing exercises.

Balancing Activities.

The outcome of this work should be control of equilibrium in stationary positions as well as in locomotion. These activities involve a very fine interplay of opposing muscle groups, which in turn has a quieting influence upon the nervous system.

Main Activity—Knee bending half deep and later to full depth with knees pressed firmly together, executed in the closed toe-stand; in the step toe stand. Varied by placing or raising feet forward or backward and changing to balance stands on one foot; combined with locomotor movements.

Complimentary Activities—With arms moving freely in a horizontal position to aid in the balancing movement; the knee bending movement may be done with trunk twisted or lowered backward. Hints on breathing.

Mimetic Activities.

Mimetic activities may be either of a playful or combative nature. Those of a playful nature are many, and of both the locomotor and stationary type. Examples: the see-saw, hammering, sawing, clock pendulum, elephant walk, flying birds, trotting and galloping horses, the train, the auto, etc., etc.

Those of a combative nature consist of fencing, boxing, and striking movements; with practice in assuming guard, attacking and parrying, advancing, and retreating, and leaping forward and backward, to which must be added the proper arm positions and movements as well as hints on breathing.

Activities for the Control of the Center of Gravity.

This group deals principally with moving the center of gravity of the body in a vertical direction, less with moving it horizontally. Whereas most of the activities previously enumerated deal with horizontal bodily control, in these the body is tossed upward and downward and yet always finds itself in a purposely planned position.

There is less of rhythmic continuity in this work, movements being frequently interrupted by pauses. During pauses complete relaxation prevails.

Main Activity—Dropping to seats and jumping to stands again; dropping slowly and also suddenly to various lying positions and returning in different ways to a stand; practiced from standing positions, balancing positions, from jumping, and from other stationary or locomotor activities.

Complimentary Activities—It is important to teach the correct movements of the arms so that they will assist in the fall, and in jumping upward.

Rhythmic Body Swings.

Rhythmic body swings may be selected from Rudolf Bode's "Expressional Gymnastics."[21] The swings used are performed forward, backward, laterally, and inward and outward in small stride stands and involve movements of the entire body. There is constant bobbing associated with the swings. When the swings have been mastered arm circles are added.

[21] Bode, Rudolf, Ausdrucksgymnastic, Published by C. H. Beck. Munchen, 1925.

X.

The objectives of these activities are few but valuable. To boys they should give the joy that dancing gives to girls, the joy that comes from free, unrestricted play of rhythmic bodily movements. Only the fun-aspect of the work appeals to boys, but there are other significant contributions to the aims of physical education.

We may expect:

1. To cultivate rhythm by diminishing and removing inhibitions and by developing the harmonious rhythmic interplay of all body parts.
2. To strengthen bodily organs, improve physiological functions and powers of coordination. This work thus aids in making pupils healthy and physically fit for life's task.
3. To develop poise. Confucius has said, "Poise is the greatest virtue." Objectives one and two are important elements in its development. With its development comes the elimination of self-consciousness.
4. Opportunities for the growth and expression of individuality. The pupils express themselves by means of bodily movements in a manner peculiar to themselves which is possible because the form of execution is never accurately defined.
5. Recreational Values. Because of the automatic nature of these activities, the joy that they produce, and because of their rhythmic flow they serve recreational purposes as well as any other activity. Body and mind are refreshed and the spirit made buoyant.
6. To develop an appreciation of the beautiful in form and movement. The instructor should grasp opportunities to point out the artistic aspects of motion and position. Many occasions for this arise in polymotor rhythmics.

Grade objectives are not given in this paper. Specific objectives of each group of activities are suggested in their description.

Opportunities for the practice of social behaviour are not frequent in this work. They do occur when pupils observe and criticize each other and work together in small groups; or in large group performances. Instructors will use such moments to develop the "give and take" attitude in criticism and the feeling of cooperating in group achievement.

Children should acquire a knowledge of rhythmic patterns and how to fit movements to these. There should also grow out of the work improved skill in the so-called natural activities, as running, jumping, etc., and in many complex bodily movements.

We believe that a type of activity as is herein presented and described is essential for the education of youth. It will serve as an additional antidote to our machine age. All about us the mechanistic principle holds sway. We use the machine for locomotion and avoid the natural and healthful course; we use mechanical equipment for the largest part of our work in the home and office or shop; nearly everything we produce is made by machines; even our calculating is done for us. Many maintain that all of this has added to the enjoyment of living, which is true. But to what kind of enjoyment? Not to the enjoyment that comes from contentment growing out of leisure used with discernment. It has removed drudgery and given us more free time, but one may question whether it

has added to our happiness. Happiness, after all, depends much upon living our lives as we wish; of being free to do the things by which we are attracted. The pleasure that was once associated with many forms of work that gave the individual opportunities for self-expression is no more. Work and play, and also art, though on a low level, were formerly one. Today there is neither play nor art to be found in the production of things.

One wonders what Ruskin, the practical idealist, would say to this separation of work and art. Would he not raise his voice in protest? To him, "Life without labor is guilt; labor without art brutality."

The influence of this materialistic age can be offset, to some extent, by fostering and developing the natural impulses for activities and by proper use of leisure. To "Loaf, and invite the Soul," is by no means to be neglected.

Results of a much graver nature are often charged to these conditions of our civilization, such as the increase in the populations of institutions for the mentally unbalanced. We do not know whether there is any relation between this increase and our mechanized civilization. There is a common aspect, however. There is an absence of pure rhythm in both. Mentally disturbed people are rhythmic in their behaviour and movements.

Human beings sense the lack of the rhythmic element in their lives and instinctively adopt defensive and protective measures against the harmful influences. The fashion of collecting antiques was mentioned as such. So-called jazz, with its simple, primitive rhythm and its clanging sound, is not a progressive achievement of our machine age, as is claimed, but rather an atavistic expression, and an antidote to counteract its mechanical meter. Dancing to this rhythm is closely related to the dances of primitive people. The tremendous popularity of sport and its huge spectacles, though educationally unsound as now conducted, is due to the opportunities given crowds of people to spontaneously and freely express their feelings. These people have fled from the monotony of their machine-like existence which suppresses all self-expression and obliterates individuality.

Polyrhythmic activities give abandon and rhythm and permit the freedom of expression absent in our daily occupation and therefore compensate us for this loss. Their practice should be the concern of all who work and should be encouraged as leisure activities. They should be made part of the daily instruction of children to offset the group of intellectual activities composing the daily routine.

They do not and should not take the place of games, athletics, tumbling and stunts on and off the apparatus; nor of swimming and hiking, but they make a valuable substitute for the obsolete type of free exercises with and without hand apparatus. The milder forms serve as an activity to augment the dancing of young women.

Two Investigations in the Orthopedic Field*

THE RELATIONSHIP BETWEEN VARIATIONS IN THE ANTERO-POSTERIOR CURVES OF THE SPINE AND SCOLIOSIS

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This thesis was a study of the relationship between variations in the anteroposterior curves of the spine and scoliosis, or rotaro-lateral curvature, made on 100 Wellesley College students. No attempt was made to determine any causative connection between the two variations. The purpose, in brief, was to determine whether, (1) variations in the anteroposterior curves accompany scoliosis, and (2) if so, whether the kinds of variation are correlated with respect to type or location.

Pictures were taken of each subject, one a side view to graphically represent the anteroposterior curves, a second, a back view to show the lateral curve, and a third in many cases, with the spine of the subject flexed to show the presence of rotation, evidenced by an abnormal prominence on one side.

In the case of the side view for recording the anteroposterior curves, since the ordinary photograph was not sufficiently accurate on account of projecting scapulae, muscles, etc., a method was used which specifically determined the location of the spinous processes and thus of the curves. This method will be described in detail in a later paper.

The photographs were projected to life size on a screen, and tracings made of both the lateral and anteroposterior curves with the same fixed point for the seventh cervical vertebra. In this manner the exact relation of the variations in the two planes with respect to location could be accurately demonstrated.

The final estimation of variations in the anteroposterior curves, which must of necessity be on a subjective standard, was made on the basis of the separate gradings of four persons. The need for a standardized method for judging anteroposterior curves cannot be overemphasized.

Although the results of study on a relatively small group of subjects can in no case be considered absolute evidence, especially when, as in the

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* These articles are abstracts of theses presented in partial fulfillment of requirements for the Degree of Master of Science in Hygiene and Physical Education at Wellesley College, June, 1929. The first thesis reported represents but a small part of the work done by the holder of the MacAusland Fellowship for the study of Orthopedics in relation to Hygiene and Physical Education for the year 1928-1929.

experiment, they are dependent to a great degree upon the subjective evaluation of types, this study, points to the following conclusions:

I. Variations in the anteroposterior curves of the spine tend to occur with scoliosis to the extent evidenced by a difference of about 23 per cent in the proportion of normal curves in the average unselected and this selected group. This tends to show that a change from the normal in one plane, with a consequent decrease in the mechanical efficiency of the spine, is accompanied or followed by a corresponding change in the other plane.

II. There is no positive correlation as to the types of variations in the anteroposterior curves with which scoliosis, in general, or specific types of scoliosis most frequently occur. For example, the frequency of scoliosis with all types of the former is relatively equal, nor does a dorsal scoliosis show any tendency to exist with an increased dorsal physiological curve.

III. There is no positive correlation between the exact location of the variations in the anteroposterior curves and that of either the lateral deviation, or rotation, although they were found to coincide, with respect to at least one of these factors in scoliosis, in 50 per cent of the cases studied.

CHRONOLOGICAL VARIATIONS IN THE POSTURE OF CHILDREN AGES ONE TO SEVEN AND TEN TO THIRTEEN

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It is the purpose of this study to discover what relation there may be between age and posture and thus to determine whether or not the standard of posture should be differentiated according to age.

Only recently has the age of the individual appeared of importance, most of the studies having been concerned with adults. But it has become obvious that the primary problem lies not in the adult but in the child or infant in whom this adult has his origin.

Since there are various mental and bodily characteristics manifest at different ages, might there not also be certain postural characteristics of different ages? It seems logical to expect that the change from the posture of the infant to that of the adult is a gradual one and that the different age periods might represent the various stages in the process. If such is found to be the case the postural education of our children will be accordingly a step at a time, there being a different standard for each age group. Such a phrase as the "postural age" may be considered with the mental age, physiological age and chronological age.

The study is confined to the variations in the anterior-posterior relationship of the parts of the body, as observed in children between the ages of one and fourteen. In studying the body mechanics of an individual one considers the following observations of prime importance.

1. The position of the head and inclination forward of the cervical spine.
2. The tilt and position of the scapulae.
3. The angle of the sacrum, which is at once an indication of the inclination of the pelvis and the acuteness of the lumber curve.
4. The weight distribution, particularly as it affects the anterior-posterior relation between the pelvic girdle and the shoulder girdle.

The method used to determine the position of each segment was based on that devised by Miss Caroline Tarbell. A protractor was made from cardboard. An arc of 180 degrees was pasted onto the cardboard and a plumb bob hung from the exact center of the diameter. The side of the protractor was used to parallel the object to be measured, while the plumb bob served to indicate the vertical. By means of this protractor angles were measured on each child and accepted as indices of the position of each segment.

The objectivity of the method was sufficiently tested by a high correlation between two sets of measurements taken by two examiners on several individuals. ($r=.931$, probable error $\pm .019$). Although the percentage difference between the measurements, 12.42 per cent, is somewhat large it will suffice for this study since it is not the purpose of the study to find an objective method of measuring. Reliability, as indicated by the average percentage deviation of the measurements taken by one examiner, 5.9 per cent, is more important than objectivity since comparative values, not absolute values are sought. If the measurements were to be continued by others, however, a high degree of objectivity would be necessary.

Each child was measured according to the profile presented by the left side, as he stood in his natural position.

1. The angle which the central axis of the neck makes with the vertical is a measure of the position of the head and neck. The side of the protractor was placed parallel to the central axis of the neck, the plumb bob serving to indicate the vertical. The angle between these two was taken as an index of the head position. The measurement was facilitated by observations as to the relation between the tip of the ear and the acromial end of the clavicle.
2. To measure the degree of tilt of the scapulae the protractor was placed parallel to its vertebral border and the deviation from the vertical was recorded.
3. The sacral tilt was indicated by that angle between the approximated line of the medial sacral crest and the vertical. The measurement, taken from the side, was difficult because the lateral aspect of the sacrum is concealed by muscle and adipose tissue. Since the medial crest of the sacrum is subcutaneous, an observation from behind made its measurement from the side less difficult.
4. The anterior-posterior relation between the shoulders and hips, or the body tilt, was measured by the angle which a line parallel to the central axis of the body, above the pelvis, makes with the vertical. This line is usually determined by the position of the anterior superior spine of the ilium and the acromion process.

After these measurements were made, a photograph of the left side was taken of one hundred cases. The same measurements were repeated on the photographs by means of lines.

It was hoped that the two sets of measurements would coincide, demonstrating the two methods to be of equal accuracy. But the correlation ratios

between the measurements on the pictures and the measurements on the children, were low. However this does not disprove the validity of the picture method; it only suggests that measurements made on a small figure give a greater chance for error than larger scale measurements on the children themselves.

The data was classified for study, according to chronological age and sex. If such were possible, classification according to physiological age would have been better. However it is assumed that, in the majority of cases, the physiological age and the chronological age are approximately the same.

Four age groups were studied in particular, ages one to three, four to five, six to seven and ten to thirteen (inclusive). The total number of cases was 158, 11 of which were from one to three years old, 34 from four to five years old, 50 from six to seven and 63 falling in the group ten to thirteen years of age.

The material for each age group was then organized into the form of a frequency distribution, showing the central tendency and the degree of variability in the measurements for each angle (cervical, scapular, sacral and that representing the body tilt).

Treating these distributions statistically the writer studied the central tendency as indicated by the Mean, and the spread of variability as indicated by the Range of the measurements, the Standard Deviation, and the Average Deviation from the Mean. Thus organized the data afforded comparison of the age groups.

SUMMARY OF RESULTS

I. *The Cervical Angle*

From the age of one year to six or seven years the cervical inclination gradually decreases. Thereafter a very marked increase is noticed up to the thirteenth year.

II. *The Scapular Tilt*

The degree of scapular tilt increases up to the fifth year at which time it is at its maximum. There after the tilt is markedly decreased and the scapula loses its winged appearance.

III. *The Sacral Angle*

Very slight in the first year, the sacral angle gradually becomes more acute until the seventh year. Between the ages of ten and thirteen a very marked decrease is shown.

IV. *The Tilt of the Body*

The erect trunk of the very little child is increasingly tilted backward as he grows older. The maximum body tilt is at the age of thirteen, the limit of this study.

Summarizing the data from another angle one might describe four children, each of which is representative for his age group. The child not

yet three years old has a slightly forward head and neck, his trunk is very erect and the sacral angle is hardly distinguishable. The scapulae are forward and on the sides of the chest, untilted, and in a sagittal plane. At four and five years, the head, though not yet erect, is less forward and the trunk is quite erect (exceptions are more numerous than in the younger group). The sacral angle is more noticeable and the pelvic inclination slightly greater. The scapulae are rightfully termed "winged." The child six or seven carries his head erect and poised directly above his shoulders. The sacral angle however is marked, the forward tilt of the sacrum being more evident at this age than at any other. The body is tilted correspondingly more. The school child from ten to fourteen has a most striking contour. The scapulae have reached their position flat against the back, but the head and neck are markedly more forward than in the case of the smaller children. The lumbar curve and pelvic obliquity are much less and the body tilt marked.

CONCLUSIONS

I. The age at which the normal relation of the body segments is established has been indicated by authorities as the third year, but this study seems to indicate:

1. That the head is not held completely erect until the sixth or seventh year.
2. The scapulae are extremely tilted at the ages of four and five and have not reached a sufficiently posterior position to lie flat upon the back until the ages of ten to thirteen.
3. At three years of age the sacral angle is very slight. It increases markedly up to the age of six or seven. Thereafter a distinct decrease is noted.
4. This study bears out the statement that the infant is more erect than the child.

II. These postural characteristics of children do not conform to the standard of posture for adults but are perfectly normal according to their physiological age. Poor posture from the age of ten to thirteen may be the result of several years of school life, and other environmental factors rather than of physiological age.

III. The age of a child is an indispensable factor in a consideration of his posture. There should be, therefore, a standard of posture for each age group.

The Role of Fantasy in Play Life

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Stanley Hall reminds us "All are young at play and only in play, and the best possible characterization of old age is the absence of the soul and body of play." This powerful intellectualist and friend reminds us constantly of the fact that the compelling force of play is not in imitative multiform physical activity, but in the moving psychic states which form the soul of this pleasurable experience and tends not to prepare us for life so much as to create the joyous healthy content of immediate normal living. Among the psychic states of early play life the mechanism of fantasy at once confronts us with most important questions. What is the proper balance between fantasy and reality in play life? What is its origin and nature, its normal mode and extent of expression? It is the purpose of this article to call attention to some of the phenomena of fantasy in play life rather than to attempt a discussion of the theories which seek to answer these questions.

In the first place the projection of the mental fantasy pictures through play activities cannot be considered as an absolute entity in contra-distinction to reality. The fantasy reaction in the individual is conditioned by many things. It has its big day, so to speak, in early child life. From this period there takes place a gradual merger with reality until in adult life this particular psychical phenomena loses its predominance and the individual becomes more materialistic and practical as he expresses it. The over-indulgence in day dreams at this period becomes a mental indiscretion with a psychosis or psycho-neurosis as a remote possibility. The motivations to fantasy are of interest in this connection. In old age there is often a defense reaction against the retirement from strenuous activity. In youth, however, this illusional idealistic mental picture is often induced by the expansion of all the functions of virile living and is to be looked upon as a most healthy rational phenomena intimately associated with the progressive and periodic development of the child.

The early fantasy creation of children in their play life has been the subject of most interesting interpretations. One may say that generally two lines of thought have developed; one which treats this phenomena as wish-fulfillments and the other which treats of them as compensations. The wish-fulfillment theory is based upon the conduct behavior of children as they transform objects and situations in conformity to pleasurable ideals. The stick becomes the gun with which the imaginary lion is slain. The wish is a dynamic manifestation paralleling the physical and mental de-

velopment of the child. This theory operates upon a basis of symbolization so potent in the child's reactions. It is of significance in this connection to point out that whereas the child himself is but the potential representative of reality as symbolized to him in the mature adult and is constantly surrounded by toys and softened pictures in the form of tempered situations, it seems but natural for him to accept this idealistic as opposed to a realistic viewpoint of life.

The child is surrounded with the small soldiers which he transforms into giants, the miniature auto bus which he mentally transforms to carry all his friends to the circus. He is spoken to as a "big man," "Daddy's man," etc. He is placed into unreal situations, he experiences the "mothering tyranny of love." His mistakes do not bring their normal punishment. The atmosphere of his early life is softened and mollified so that he finds in this fantasy a pleasurable medium of self-protection, self-aggrandizement and pleasurable satisfaction.

The compensation theory is closely entwined with the progressive adjustment of the child to the rigors of life. Fantasy creations establish a vista of the desired steps ahead. The individual cannot accomplish what his larger brother can, the unrealized desire becomes an idealistic day dream. The act itself being inhibited finds an outlet in an ideal execution in fantasy and finds its accomplishment in play.

Generally, when the child plays, he first transforms personalities. His father becomes the lion which the hunter must destroy.

Some psychologists have called attention to the role of fantasy as a contributing factor in providing effective psychic impulsion to play. One need hardly comment upon the fact that the mechanical aspects of play are but the outward manifestations of this effective inner impulse and that the beginning, continuance and rest periods are most vitally related to the strength of this psychic motivation. This situation leads to a consideration of two aspects of the play impulse. First, mechanisms relating to the real or mechanical elements and second, those which pertain to the ideal or illusional or fantasy field. One can readily appreciate the fact that all these parts of the play experience are rational elements for the full growth and expression of the individual. The fantasy ventures into realms where the wishes are fulfilled may simply represent a part of the totality of play which seeks to integrate work and art into this experience for the full preparation to living. This position would seem to be strengthened when we consider the evolution of fantasy creations in chronological ages.

From the ages of two to nine, the child characteristically conditions his play activities with fantasy substitutions. His physical restrictions are expanded with symbolical representations. He cuts the imaginary Indian's head off with the wooden knife and thus ideally destroys the stronger object. His play adventures are characterized with but a weak attachment to reality. The hard contacts of material things are not allowed to enter and

destroy this pleasurable psycho-motor content which provides the zest of this activity.

This rational role of fantasy is continued through adolescence which Stanley Hall terms "the birthday of the imagination" but there is a gradual ascendency of the real over the ideal until old age and often senility, when the abnormal factors enter to transform fantasy into delusional and hallucinatory elements of a psychosis or psycho-neurosis as has been previously pointed out. It has been observed that we cease to play not because we are old, but, conversely, we are old because we have ceased to play. The gradual weakening of the fantasy mechanism as age advances undoubtedly exerts a most important influence in limiting the play activities as the psychomotor motivation becomes progressively weaker.

When we consider the nature of the fantasy mechanism we are impressed not only with its rational character but also with its utilitarian role. As has been pointed out, this mental picture which conditions play is based upon the realization of some normal growth objective. For example, Witty and Decker found that negro children are retarded when a mental comparison is made with white children. It has been statistically proven by Lehman and Witty that negro children play school much more frequently than white children. While this reaction is explained as the dramatization of adult activities by some, it appears that a more comprehensive answer is found in the utilitarianary objective which, in this case attempts to make up for a racial deficiency.

This imaginative field so naturally unfolded through the agency of play experiences, may be also considered in the light of symmetrical development into complete and hence joyous and beautiful living. This is the Socratic ideal so interestingly presented by Jean E. Chryssafis. The psychic appeal of exercise vitally related to the normal expression of the child cannot be considered as something apart from the study of physical education. As Jesse Williams points out, the fundamental point of view "holds that physical education of a kind has a great deal to contribute to fine and wholesome living, that it is essential to a sensible plan for leisure time education and that it is indispensible in the education of people in important motor skills. These three ideas are intimately bound together and each re-inforces the other." It is evident that this fantasy concommitant has a most important role in provoking and conditioning the satisfaction which presupposes, attends, and follows play ventures. The play mechanism cannot be viewed as the motor execution solely. It appears very probable that the anticipation and the retrospect offers not only the more lasting satisfaction, but establishes the synthetic balanced idea of what we mean by play in all its fullness and in its most vital relationship to wholesome living.

The writer in directing the play life of psychotic and psycho-neurotic patients over a period of years has found abundant opportunity to observe the role of fantasy in both its rational and irrational nature. It is very interesting to observe the projections of imagination in these cases. In general,

the problem of the therapist is to create in the patient a sense of the superior joys of reality as compared to his delusional or hallucinatory creations. Fantasy may cause the patient to either commence or discontinue a play activity. If the psychic phenomena is in sympathy with the development of his irrational thought creation, he will often participate impelled by this abnormal stimulation. In the actual participation, the patient may make false-identifications of himself or others with their bizarre ideals. For example, he may believe himself to be a member of a major league baseball team or to be playing with others who are. He may play to satisfy his exaggerated ego or to gain strength so that he can kill his imaginary enemies. The deteriorated patient conditions his fantasy sphere with instinctive cravings related in many cases to the phylon and to feral existence.

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A Study of Stature in Relation to Physical Performance

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I. *Statement of the Problem.*

Since Reilly's study[1] in 1917, considerable attention has been paid to the factors of age, height and weight with reference to the physical performance of elementary and high school boys. Though we are not agreed that the classification scheme which is now most used (namely, the four-point classification or the classification by age, grade, height and weight) is the best method or that it has any particular scientific basis for its establishment, men and women generally in the profession feel very strongly that factors of age, height and weight have a very decided effect upon the matter of performance. McCloy[2] has shown that for elementary and high school boys the factors of age and weight play the most important part and that the best handicapping formula is 8A plus W where the age is computed in years and the weight in pounds. Rogers[3] has proposed a classification by means of a combination of strength tests which gives consideration to both height and weight and which provides strength index norms for a particular weight at a given age from 10 yrs. 6 mos. to 18 years.

Up to the present time no study has appeared which deals with men of college age. The question may be asked, "What influence do the factors of age, height and weight have on performance with college men?" This question is a vital one for collegiate departments of physical education because, if these factors influence performance, we shall have to give them consideration in the establishment of performance norms. In an unpublished study made by the writer in 1925 it was shown that with 408 cases of unselected college men the intercorrelations, between six events, composite score and the factors of age, height and weight, ran as shown by the table on the folowing page:—

These figures show quite conclusively,

1. That there is a negligible correlation between age and height;
2. That there is a negligible correlation between age and weight;
3. That age has no bearing upon performance in general athletic ability tests;

[1] Reilly, F. J. New Rational Athletics for Boys and Girls.
[2] McCloy, C. H. Athletic Handicapping by Age, Height, and Weight. Am. Phys. Educ. Rev. 33: 635-648, Nov. 1927.
[3] Rogers, F. R. Physical Capacity Tests in the Administration of Physical Education.

4. That height and weight are apparently influencing factors to some extent in the matter of performance, though the correlations are not of sufficient size to use in predicting performance.

TABLE I

Intercorrelations—Athletic Ability Tests—College Men
(University of California at Los Angeles)

	Rope	100 yds.	B.J.	H.J.	Shot	Discus	Composite	Age	Hgt.
13-ft. Rope Climb									
100-yd. Dash	.263								
Running Broad Jump	.269	.462							
Running High Jump	.125	.408	.400						
Shot Put	.138	.307	.365	.356					
Discus Throw	.110	.279	.395	.427	.569				
Composite Score minus event in question	.250	.523	.587	.486	.446	.521			
Age	.080	.012	—.001	.011	.018	.006	.028		
Height	—.100	.094	.200	.297	.395	.337	.292	.046	
Weight	—.171	.112	.140	.159	.520	.405	.268	.052	.583

II. *Technique and Data.*

In order to formulate height and weight groups for use in this study, thirty-nine hundred sixty five cases (3965) of entering college freshmen (U. C. L. A. from 1919 to 1926) were used. Tables II and III represent the Age and Height distributions respectively.

TABLE II

Age Distribution

Age	No. Cases
16	98
17	460
18	1023
19	873
20	607
21	392
22	225
23	123
24	102
25	62
N	3965

TABLE III

Height Distribution

Height	No. Cases
4-11	2
5-0	3
5-1	13
5-2	36
5-3	59
5-4	106
5-5	194
5-6	362
5-7	516
5-8	566
5-9	674
5-10	522
5-11	407
6-0	270
6-1	125
6-2	78
6-3	23
6-4	9
N	3965

The height distribution was first divided into three classes, the middle 50% representing those at medium height, the top 25% those who are tall and the bottom 25% those who are short. The statistical material necessary is shown in Table IV.

TABLE IV

Statistical Material

Mean Height—68.62 in.	S. D. (H)—2.56 in.	P. E. (H)—1.725 in.

Using Mean plus or minus one P. E. for Medium Group we have theoretically

Medium—50% of cases	Tall—25% of cases	Short—25% of cases
	or	
Tall—5' 10½" and up	Medium—5' 7" to 5' 10½"	Short—Up to 5' 6¾"

Since age need not be considered in the classification, distributions of weights for each inch of height were made from 5 ft. 2 in. to 6 ft. 2 in. and means and probable errors (P.E.) computed. The medium weight group for each height, namely mean plus and minus 1 P.E., represents the middle 50% of the cases, with the upper 25% representing the heavy group and the lower 25% the slender group. Because of the small number of cases below 5 ft. 2 in. and above 6 ft. 2 in., it was necessary to interpolate these weights from the Height-Weight Table of the Child Health Organization. Table V shows the necessary data to divide all men into one of nine distinct classes, namely,

Tall Slender	Medium Slender	Short Slender
Tall Medium	Medium Medium	Short Medium
Tall Heavy	Medium Heavy	Short Heavy

TABLE V

Height-Weight Classification for College Men

Height	Slenders	Mediums	Heavies	Height	Slenders	Mediums	Heavies
4-11	Up to 93	94-110	111 up	5- 8	Up to 128	129-147	148 up
5- 0	Up to 98	99-115	116 up	5- 9	Up to 131	132-150	151 up
5- 1	Up to 103	104-120	121 up	5-10	Up to 135	136-154	155 up
5- 2	Up to 107	108-126	127 up	5-11	Up to 138	139-158	159 up
5- 3	Up to 109	110-126	127 up	6- 0	Up to 139	140-162	163 up
5- 4	Up to 115	116-133	134 up	6- 1	Up to 144	145-165	166 up
5- 5	Up to 116	117-134	135 up	6- 2	Up to 150	151-172	173 up
5- 6	Up to 121	122-139	140 up	6- 3	Up to 156	157-178	179 up
5- 7	Up to 125	126-143	144 up	6- 4	Up to 162	163-184	185 up

For the past three years the method used in classifying men for teaching purposes in physical education (University of California at Los Angeles) is that worked out by the writer[4] which includes tests in seven athletic ability events, 12-foot baseball throw, football punt, dive for distance,standing broad jump, dip on parallel bars, dodging, and quarter-mile run. If it can be shown that there are decided differences in scoring power by the various stature groups both in the individual events and in the total or composite score, then some adjustment must be made to give those handicapped by lack of height or weight or both a fair and equal chance with all the others. This was not done when the original study was made.

Data used in the study represent the records of all men who took the test in the fall semester of 1928 and the spring semester of 1929, a total of 601 cases. Table VI shows the mean score of all groups and the various combinations which may be made in these groups both as regards total

[4] Cozens, F. W., The Measurement of General Athletic Ability in College men.

score and score in each event or test. The scores are listed in T-Score points which makes possible comparisons between scores made in the various events as well as insuring more ease in computations[5].

The reliability of differences between means was established by the "standard error of difference" formula[6] together with the fact that a D/8

TABLE VI
Mean Score in Stature Groups—General Athletic Ability Test

	No. Cases	G.A.A. Test Total Score	Baseball Throw	Football Punt	Long Dive	Standing Broad Jump	Dip	Dodging	Quarter-mile
Tall-Group	147	350.65	55.47	49.42	50.78	51.25	46.59	47.75	46.49
Medium-Group	297	350.16	53.89	47.27	51.50	50.77	51.95	48.67	45.92
Short-Group	157	329.20	49.36	42.54	49.58	47.00	52.19	47.73	43.85
Slender-Group	145	324.65	48.17	43.55	48.24	47.03	48.96	47.17	43.10
Medium-Group	306	349.10	53.68	46.67	51.25	50.71	51.95	48.34	46.66
Heavy-Group	150	354.87	56.63	49.23	52.43	51.03	49.84	48.90	45.53
Tall-Slender	36	338.60	52.00	46.31	50.06	47.97	46.03	47.83	45.47
Tall-Medium	76	359.20	56.47	49.43	52.06	53.38	49.10	48.45	47.99
Tall-Heavy	35	344.40	56.86	52.57	48.71	50.00	41.71	46.14	44.29
Medium-Slender	72	327.36	48.67	43.74	48.46	47.90	50.96	47.21	43.18
Medium-Medium	148	353.20	54.57	47.78	51.43	51.12	52.03	48.79	46.49
Medium-Heavy	77	365.50	57.45	49.60	54.48	52.78	52.71	49.79	47.39
Short-Slender	37	305.81	43.49	41.19	46.05	44.43	47.95	46.46	40.65
Short-Medium	82	333.42	49.50	42.12	50.17	47.49	54.44	47.43	45.72
Short-Heavy	38	342.90	54.76	45.42	51.73	48.45	51.47	49.63	42.92
Slenders-Tall	36	338.60	52.00	46.31	50.06	47.97	46.03	47.83	45.47
Slenders-Medium	72	327.36	48.67	43.74	48.46	47.90	50.96	47.21	43.18
Slenders-Short	37	305.81	40.51	41.19	46.05	44.43	47.95	46.46	40.65
Mediums-Tall	76	359.20	56.47	49.43	52.06	53.38	49.10	48.45	47.99
Mediums-Medium	148	353.20	54.57	47.78	51.43	51.12	52.03	48.79	46.49
Mediums-Short	82	333.42	49.50	42.12	50.17	47.49	54.44	47.43	45.72
Heavies-Tall	35	344.40	56.86	52.57	48.71	50.00	41.71	46.14	44.29
Heavies-Medium	77	365.50	57.45	49.60	54.48	52.78	52.71	49.79	47.39
Heavies-Short	38	342.90	54.76	45.42	51.73	48.45	51.47	49.63	42.92

The above figures are all in T-Score Points. Values for T-Score points in the seven events are approximately as follows:

1 T-Score	2.5 ft.	2/3 yd.	3 in.	3/4 in.	2/5 dip	1/10 sec.	1/2 sec.

[5] For those readers who are not familiar with the T-Score, it may be noted that the T-Score or T-Scale is based upon standard deviation units and equal T-Scale scores on different tests, representing the same relative distance above or below the mean, are therefore comparable. Fifty points being the mean, in a normal distribution a T-Score of 60 represents performance at one standard deviation above the mean and a T-Score of 40 at one standard deviation below the mean. Total or composite scores are computed by the simple addition of the T-Score points for individual events. For further information see McCall, W. A.—"How to Measure in Education," and Brace, D. K., "A Method of Constructing Athletic Scoring Tables," Am. Phys. Ed. Rev., April, 1924, or Smith, H. L. and Wright, W. W., "Tests and Measurements," p. 533.

[6] Kelley, T. L., "Statistical Method," Formula (140), p. 182.

of 3 or more is usually taken as indicative of complete reliability[7]. D in this case refers to the obtained difference and o-d to the standard error of the difference.

III. *General Summary and Conclusions.*

1. It is unquestionably true that there are distinct and real differences between the general performance ability of a number of stature groups.

   a. The tall men as a group are superior to those who are short.
   b. The medium men as a group are superior to those who are short.
   c. The heavy men as a group are superior to those who are slender.
   d. The medium men as a group are superior to those who are slender.
   e. There is a small but real negative correlation between being *slender* and having ability to score high in a battery of seven general athletic ability tests, (bi-serial r=.355).
   f. There is a small but real positive correlation between *being heavy* and having ability to score high in the above mentioned battery of tests, (bi-serial r = .312)
   g. There is a small but real negative correlation between *being short* and having ability to score high in the same battery of tests, (bi-serial r = .251)

2. In the "slender" group there are distinct differences between Tall, Medium and Short in that order, Tall being superior, Medium next and Short inferior. Because of the number of cases in this group (145) the Talls only show superiority over the Shorts. (Standard error of difference formula.)
3. In the Medium (weight) group the Talls and Mediums are distinctly superior to the Shorts.
4. In the Heavy group, on account of the small number of cases considered (150), there are no real differences, though it is interesting to note that the Mediums score more than 20 points above the Talls and Shorts. This means that the average of the Mediums is only obtained by 34% of the Talls and Shorts.
5. In the *Baseball Throw for Distance,* the following facts may be observed.

   a. The Tall and Medium groups have a decided advantage over the Shorts.
   b. The Medium and Heavy groups have a decided advantage over the Slenders.
   c. Tall-Slenders and Medium-Slenders have a decided advantage over the Short-Slenders.
   d. Tall-Mediums and Medium-Mediums have a decided advantage over the Short-Mediums.
   e. In the Heavy group the differences are not of importance.
   f. Tall-Mediums, Tall-Heavies and Medium-Heavies are the best throwers.

6. In the *Football Punt for Distance,* these facts may be observed:

   a. In the height groups, short men are again inferior to Talls and Mediums.
   b. In the weight groups, slender men are inferior to mediums and heavies.
   c. Tall-Mediums and Medium-Mediums show a decided superiority to Short-Mediums.

[7] Garrett, H. E., "Statistics in Psychology and Education," p. 133.

7. The *Long Dive, Dodging* and *Quarter-Mile Run* do not show the decided differences in scoring ability of the various stature groups. This would seem to indicate that these events are comparatively free from the influence of stature upon performance.
8. In the *Standing Broad Jump,* the following facts appear:
   a. The Tall and Medium men show superiority to the shorts.
   b. The Medium and Heavy groups (weight) show superiority to the Slenders.
   c. The Tall-Mediums and the Medium Heavies are the best jumpers.
9. In the *Dip,* the facts are somewhat reversed:
   a. The Medium (height) and Short men are superior to the Talls.
   b. Tall-Heavy men are inferior to all others.
   c. Short-Mediums score the highest of any of the nine class groups.
10. Since the figures shown in the "Mean Score" Table have been reduced to T-Score points, they are comparable and we may compare scores made in the various events.
    a. Tall men score better in throwing than any other event.
    b. Medium (height) men also score better in throwing.
    c. Short men score highest in the *dip.*
    d. Slender men are better in the dip than any other event.
    e. Medium (weight) men are better in throwing than any other event.
    f. Heavy men are also better in throwing than anything else.
    g. Short-Slender men are better in the Dip and Dodging than in other events.
    h. Which class excels in each of the seven events:
       Baseball Throw—Medium-Heavy with Tall-Medium and Tall-Heavy a close second.
       Football Punt—Tall-Heavy
       Long Dive—Medium-Heavy
       Standing Broad Jump—Tall-Medium
       Dip—Short-Medium
       Dodging—Medium-Heavy and Short-Heavy
       Quarter-Mile—Tall-Medium and Medium-Heavy

IV. *Recommendations.*

1. Even with college men, we must recognize the superiority of certain stature groups over others. It has previously been thought that there were not large enough differences in ability to give serious consideration to this question, but it has been shown quite definitely that short men and slender men are materially inferior in performance ability. With tall, medium and short men, it is quite apparent that weight is a very decided asset to performance. The only exception to this rule is the tall-heavy man. He does not score so well as the tall-medium man but is much better than the tall-slender individual.
2. The solution to this problem is not a requirement of this paper, but it must be given consideration if we are to follow the facts as outlined here.

   Three possibilities may be suggested:

a. Start from a basic figure with the group Medium-Medium. Add a specific amount to this basic figure for the short-mediums and subtract a specific amount for the tall-mediums. Working from each of these figures, compute handicaps for all tall groups and bonuses for all short groups.

b. From a basic height and weight figure for Medium-Mediums, compute a chart for additions or subtractions of each inch value and additions or subtractions for each 5 pounds of weight value. These additions or subtractions need not go up or down in a uniform manner. Many more cases of the shorts and talls, slenders and heavies will have to be considered than were possible in this study.

c. A scale might be worked out for each of the nine stature classes. This may be the best method for scoring each event. Those classes whose mean scores lie close together may be thrown together and a table worked out for each. In the various events, we may have the following tables:

1. BASEBALL THROW
   - Table I—For Tall-Medium, Tall-Heavy, Medium-Heavy
   - Table II—For Medium-Medium, Short-Heavy, Tall-Slender
   - Table III—For Medium-Slender and Short-Medium
   - Table IV—For Short-Slender
2. FOOTBALL PUNT
   - Table I—For Tall-Heavy, Medium-Heavy, Tall-Medium
   - Table II—For Medium-Medium, Tall-Slender, Short-Heavy
   - Table III—For Medium-Slender, Short-Medium, Short-Slender
3. LONG DIVE
   - Table I—Medium-Heavy
   - Table II—Tall-Medium, Short-Heavy, Medium-Medium, Short-Medium, Tall-Slender
   - Table III—Tall-Heavy, Medium-Slender, Short-Slender
4. STANDING BROAD JUMP
   - Table I—Tall-Medium, Medium-Heavy, Medium-Medium
   - Table II—Tall - Heavy, Short - Heavy, Tall - Slender, Medium - Slender, Short-Medium
   - Table III—Short-Slender
5. DIP
   - Table I—Short-Medium, Medium-Heavy, Medium-Medium
   - Table II—Short-Heavy, Medium-Slender, Tall-Medium
   - Table III—Short-Slender, Tall-Slender
   - Table IV—Tall-Heavy
6. DODGING
   - Table I—Medium-Heavy, Short-Heavy, Medium-Medium, Tall-Medium
   - Table II—Tall-Slender, Short-Medium, Medium-Slender, Short-Slender, Tall-Heavy
7. QUARTER-MILE
   - Table I—Tall-Medium, Medium-Heavy, Medium-Medium
   - Table II—Short-Medium, Tall-Slender, Tall-Heavy, Medium-Slender
   - Table III—Short-Heavy, Short Slender

Table VII (A, B, C, and D) shows revised scoring charts for the Standing Broad Jump in comparison with the scoring chart from which all men were originally scored.

TABLE VII

T-Score Table for Standing Broad Jump

Score in feet and inches	A. Original Scoring Chart	B. For Classes Tall-Medium, Medium-Heavy Medium-Medium	C. For Classes Tall-Slender Tall-Heavy Medium-Slender	D. For Short-Slender
9: 4—9:6	79		79	
9: 1—9:3	75	75	75	
8:10—9:0	70	68	72	72
8: 7—8:9	66	64	67	69
8: 4—8:6	62	60	63	69
8: 1—8:3	58	55	60	66
7:10—8:0	54	51	56	62
7: 7—7:9	50	48	53	59
7: 4—7:6	47	44	49	55
7: 1—7:3	43	41	45	49
6:10—7:0	40	38	42	44
6: 7—6:9	37	36	39	41
6: 4—6:6	34	32	36	38
6: 1—6:3	32	30	32	34
5:10—6:0	30	29	29	28
5: 7—5:9	29	27	26	
5: 4—5:6	28	25	21	
5: 1—5:3	24	23		

In the original scoring chart, the mean jump of all groups scored 50 points or 7 ft. 8 in. This same jump for the groups in B scores only 48 points as against 53 points for groups in C and 59 points for groups in D. In other words the Short-Slenders have just as much chance of making a good score in the standing broad jump as any other group and by this method are not handicapped by lack of height and weight. These charts will naturally become more stabilized each year by the addition of other cases. It must be kept in mind that the classes in B represent 301 cases as against 263 cases for C and 37 cases for D. Figures for eight years must be gathered before the norms for the Short-Slender group are as accurate as those for the groups in B and C are now.

Physical Development of College Women 1904 - 1928

By Jesse S. Herriott, B.Sc., M.A.
Physical Director for Women, McGill University, Montreal

INTRODUCTION

This paper summarizes the results of a study of the physical development of college women for the purpose of determining the increase or decrease of the average age, weight, height, lung capacity, and obtaining a classification for general fitness.

The results were obtained by a study of the records taken at McGill University at the time of the health examination and extended over a period of twenty-four years. In each instance, the findings were compared with studies made in the similar situations of Vassar and Stanford Universities.

A STUDY OF THE PHYSICAL DEVELOPMENT OF COLLEGE WOMEN AS SHOWN BY RECORDS AT McGILL UNIVERSITY FROM 1904-1928

All entrants are required to undergo a health examination in the Fall of their freshman year, and the records used here are the result of this procedure.

During the twenty-four years over which these records extend, the examinations were conducted by the same Physician and Physical Director for Women, which fact assures a large percentage of reliability.

Heights were recorded to the nearest tenth of an inch, weight to the nearest quarter pound, age by years and months, and lung capacity to the nearest cubic inch.

The total number of women students registered from 1904-1928.

AGE RECORDS:

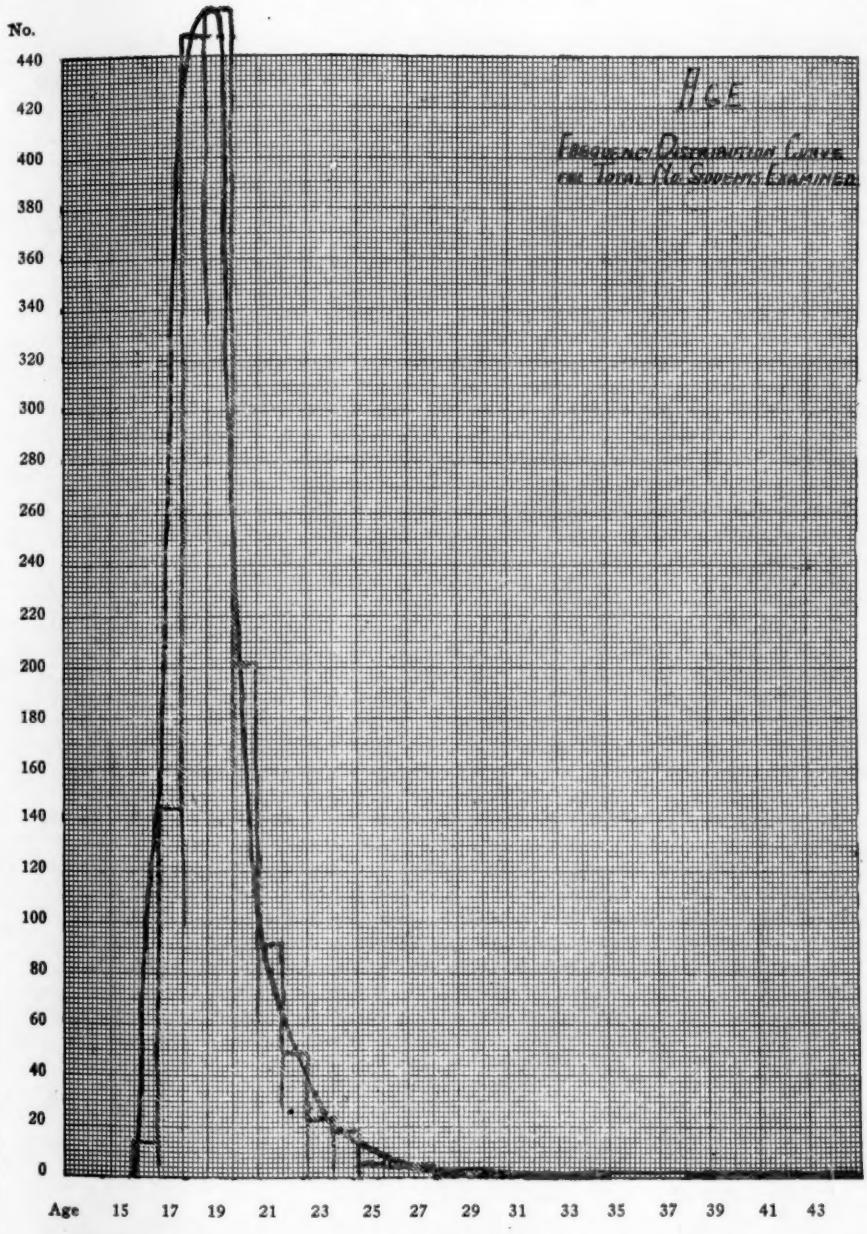
Total number of students examined, 1,478.
Age range, 1904-1927, 15-44, or 29 years.

As shown by the University catalogues from 1904-1928, no student has been admitted to the Undergraduate body who is under sixteen years of age, except under special circumstances.

The decrease in the arithmetical mean over this period of time was 2.3 years.

These results bear out the general supposition that the woman of today enters College at an earlier age than she did in previous years.

Since 1917, McGill University has accepted the Senior Matriculation



Examination for entrance into second year Arts which may presuppose a greater degree of maturity of these advanced students.

There have undoubtedly been several influential factors responsible for the decrease in age at entrance. In recent years there has been a distinct

interest in the pre-school age child and the establishment of numerous centres for the education of this age. In all probability these centres have prepared the child for school entrance at an earlier age. The Kindergartens have served to draw the younger children and may, therefore, have started the child on a school career at an earlier age.

In many institutions the age requirements for entrance have lowered. The modern tendency to promote as steadily as possible and to provide for vertical promotion rather than to require repetition and run the risk of killing the interest, may have been influencing factors. The modern curricula based on the native interests of the individual have undoubtedly appealed to the pupils, achieved a greater degree of effort, and thus stimulated learning. A decrease in the age of entrance at all levels of schooling has been recorded in many educational institutions.

HEIGHT RECORDS:

Total number of students examined, 1,499.
Height range, 1904-1927, 51-72, or 21 inches.
There has been a total increase of .79 inches extending over the entire period.

ARITHMETICAL MEAN OF HEIGHT

Year	Mean	Year	Mean	Year	Mean	Year	Mean
1904	62.72	1910	62.24	1916	63.80	1922	62.97
1905	63.16	1911	63.21	1917	62.98	1923	62.66
1906	61.97	1912	63.38	1918	63.35	1924	62.78
1907	64.23	1913	63.67	1919	62.66	1925	63.40
1908	63.55	1914	63.84	1920	63.12	1926	63.08
1909	62.97	1915	62.88	1921	62.67	1927	63.51

During the twenty-four years over which the examinations have been made, the mean has increased .79 inches.

In 1921 a similar study was made and published at Vassar College, U.S.A., which gave an increase of 1.3 inches over a period of 37 years.[1]

Dr. Clelia D. Mosher, M.D., Stanford University, conducted such a study over a period of thirty years, the results of which were published in 1921. An increase in stature was reported which amounted to from 1.0 to 1.1 inches.[2]

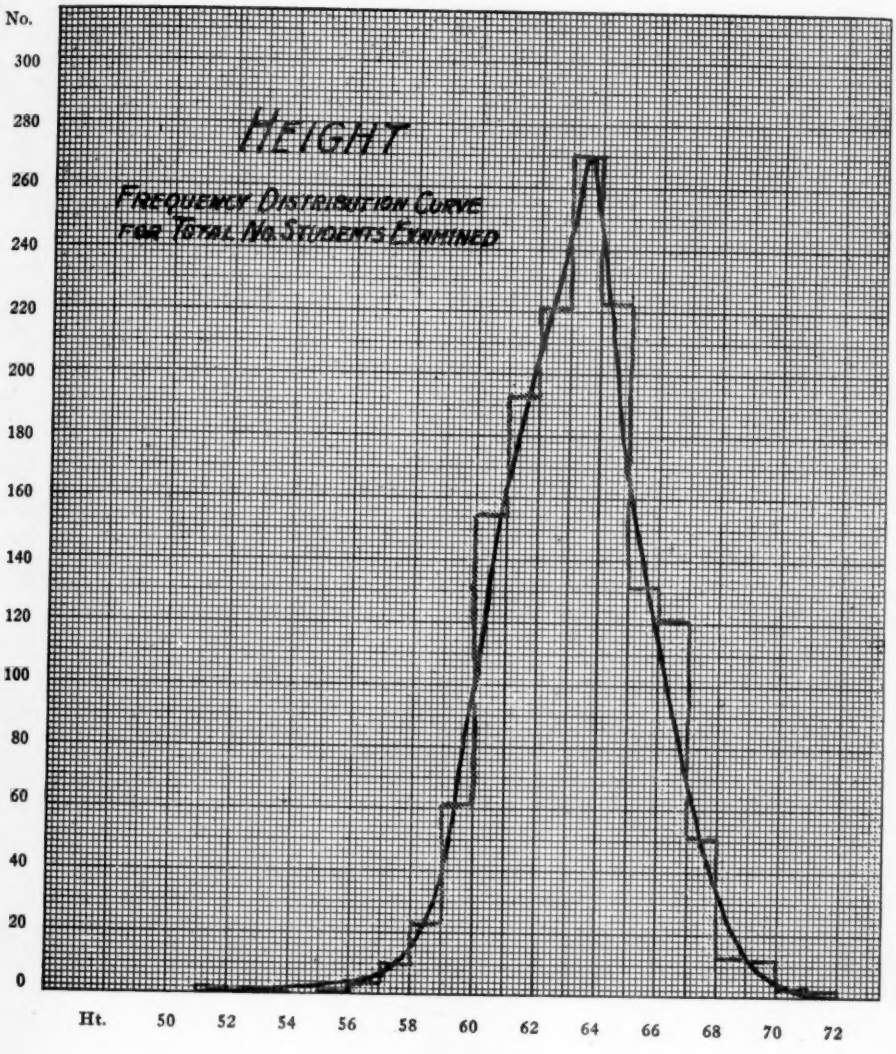
A comparative table calculated in inches may be expressed as follows:

COLLEGE	Years Observed	Average Increase Per Year	Total Increase Basis 37 Yrs.	Mean
McGill	1904-1927	.032	1.2 in.	63.08 in.
Vassar	1884-1920	.035	1.3 in.	64.9 in.
Stanford	1891-1921	.035	1.3 in.	63.5 in.

WEIGHT RECORDS.

Total number of students examined, 1,507.
Weight range, 1904-1927, 70-185, or 115 lbs.
There has been a total increase of 3.35 lbs. extending over the entire period of time.

[1] Reprinted from the Quarterly Publication of the American Statistical Association, Dec. 1921.
[2] California State Journal of Medicine, Feb. 1921.



ARITHMETIC MEAN OF WEIGHTS

Year	Mean	Year	Mean	Year	Mean	Year	Mean
1904	119.56	1910	118.60	1916	119.37	1922	118.61
1905	122.03	1911	121.21	1917	120.97	1923	121.05
1906	112.66	1912	121.00	1918	120.85	1924	119.50
1907	120.82	1913	120.19	1919	119.70	1925	121.51
1908	120.30	1914	120.54	1920	118.88	1926	118.93
1909	119.86	1915	115.74	1921	118.68	1927	122.01

The result of the Stanford University study gave the following information: "There is also a definite increase in the average weight." I regret that more detail was not published.

Comparative results may be arranged as follows:

COLLEGE	Years	Average Increase Per Year	Total Increase 37 Yrs.	Mean
McGill	1904-1927	.139 lbs.	5.1 lbs.	119.93 lbs.
Vassar	1884-1920	.216 lbs.	6.5 lbs.	122.5 lbs.

The results show a marked tendency of increase in weight. This increase in weight is gratifying in light of the rather modern fad of reducing.

The popularity of motor activities in recent years and the university increase in participation is, undoubtedly, in part due to the development of a firmer musculature and increased weight, as well as the slighter and better proportioned build.

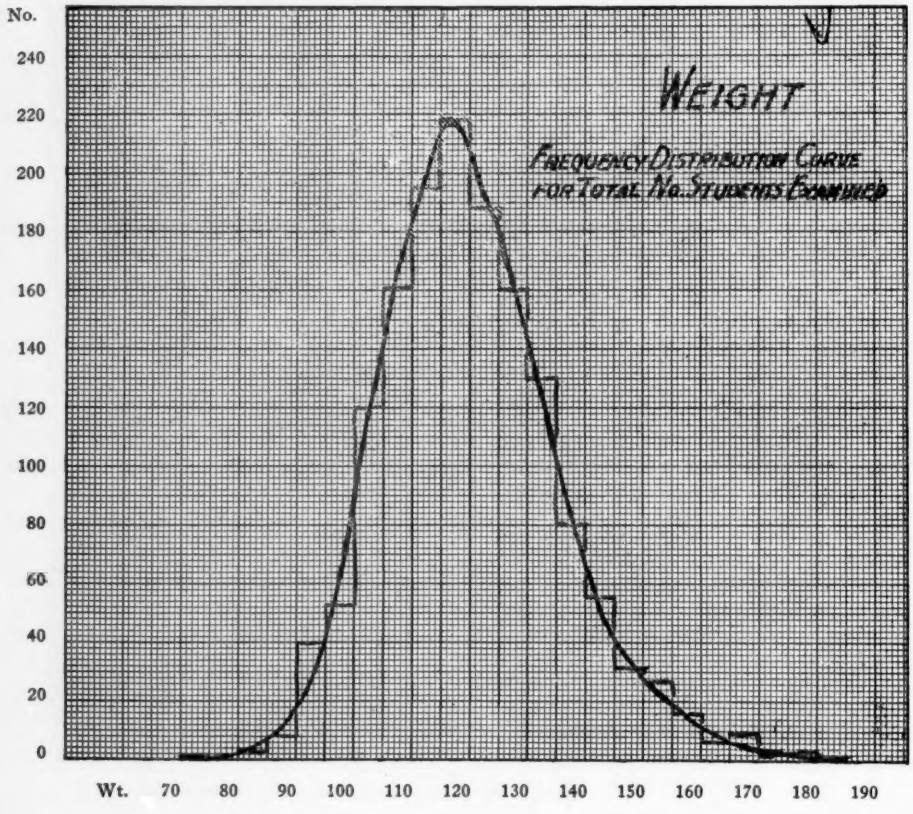
LUNG CAPACITY RECORD:

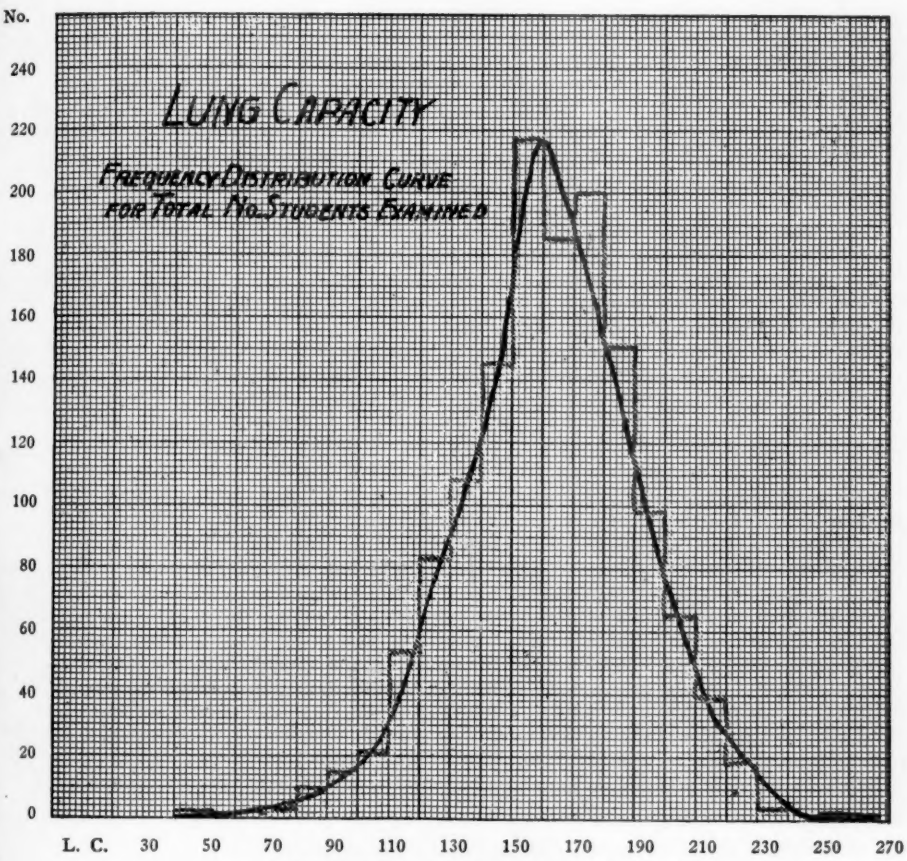
Total number of students examined, 1,417.

Lung capacity range, 1904-1927, 40-270, or 230 cu. in.

There has been a total decrease of 51 cu. in.

The method used has been to allow two trials and to record the best of the two. Although the spirometer and method used have remained uniform throughout the period of twenty-four years, the variations per individual have fluctuated sufficiently as to reduce the worth of the results.





ARITHMETICAL MEAN OF LUNG CAPACITY

Year	Mean	Year	Mean	Year	Mean	Year	Mean
1904	159.	1910	168.8	1916	157.	1922	164.8
1905	154.4	1911	157.5	1917	172.4	1923	161.2
1906	128.4	1912	164.	1918	157.2	1924	154.6
1907	149.	1913	173.2	1919	162.7	1925	149.1
1908	145.	1914	162.9	1920	177.8	1926	156.1
1909	148.	1915	151.	1921	171.9	1927	149.3

The comparative results from Vassar and McGill University are[1]:

COLLEGE	Year	Average Mean
McGill	1904-1927	159.3
Vassar	1884-1920	164.

[1] A record of the lung capacity was not included in the Stanford University Study.

Classification Record:

Since 1917, it has been customary to group the students in the following classes at the time of the health examination.

A. Fit for all forms of physical exercise
B. Fit for a limited number of forms
C. Fit for gymnasium work only
D. Fit for remedial gymnastics or temporarily unfit
E. Unfit for any form of physical exercise

This classification serves to guide the college life of the student in regard to the activity program, the academic load, and the participation in extra-curricular activities.

Total number of students classified was 1025.

During the period of 1904-1928 the records yield the following results:

A-Group, increase of 63.2%
B-Group, decrease of 35.6%
C-Group, decrease of 21.5%
D-Group, decrease of 7.8%
E-Group, increase of 1.4%

It is quite significant that the percentage falling in the A class has shown a constant increase from 25.8 per cent to 89 per cent while the percentage of all other classes has decreased. Since 1920 the mean classification has remained in the A group.

The factors responsible for these results may be appreciated at once. Within recent years there has been a constant and significant change in the aims of physical education and a definite shift from the therapeutic to the educational aspect. The modern program which presents an increasing percentage of informal game activities and which strives to develop a love for wholesome activity and a skill above the average has undoubtedly been largely responsible for the increase in participation. It is psychologically true that the ability to perform an act well leads to the desire to practice with resulting satisfaction to the individual. It is such a skill and attitude which the modern program is endeavoring to develop with full realization that the actual exercise, in which is embodied the health benefits, will be an inevitable by-product. In the past the aim of physical education has been "health" and it has been sold to the students because it was "good for them" whereas today it does not bear the mark of a dose of medicine but rather of a contribution to life, to be indulged in out of sheer joy in the participation.

The standards in health examinations have changed materially from the rather common habit of judging the student in terms of diseases and searching for defects and disorders which would classify him for special and limited work, to judging the functioning organism as a whole and encouraging participation in the wholesome group activities of the program.

A summary of the items studied may be expressed as follows: The average age of the student at time of entrance has shown a constant decrease from 20 to 17.7 years; the average height has increased from 62.72

to 63.51 inches which is slightly lower than the increase recorded in the Vassar study; the average lung capacity has shown a decrease from 159 cu. in. to 149.3 which is 4.7 cu. in. lower than the average noted at Vassar, and the A classification has shown a constant and significant increase with a corresponding decrease in all other groups.

AUTHOR'S ACKNOWLEDGMENTS

This study has been made possible by the efforts of the Department of Physical Education at McGill University, under the direction of Dr. A. S. Lamb, B.P.E., M.D., and to whom I express great appreciation for assistance in the preparation of this paper.

The information has been gathered and the records preserved by the Medical Officer of the University, Dr. F. W. Harvey, and by the Staff of the Department of Physical Education for Women, under the leadership of my predecessor, Miss E. M. Cartwright. Much help has been received from Miss M. Binmore, who computed the statistical details.

Relationship of Respiration to Speed Efficiency in Swimming

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THE PROBLEM

Breath Control Most Important Swimming Skill. It seems generally recognized that the greatest difficulty in mastering an efficient swimming stroke or feeling at home in the water is learning to breathe easily. Instructors report that *breath control* is the first and most important of all the skills to be learned as a beginner. A survey of the literature shows, however, that few, if any, fundamental principles have been established. The methods now employed to teach breathing are largely traditional rather than based upon scientific investigation. There are numerous complications, and it is believed that few swimming instructors realize all the factors about respiration in the water.

Aim of this Investigation. The aim of this study is to make a careful analysis of respiration in the water under the following conditions:

1. Simple immersion in the water without swimming.
2. Swimming various strokes.
3. Maximum speed with the racing strokes over the competitive distances.

An understanding of the fundamental principles presented in this paper should help both teacher and pupil to respect the importance of proper respiration and perhaps lead to some new pedagogical ideas. It is believed that many of the problems of swimming, previously inadequately explained, are explained by this study. Everyone knows that swimming involves a somewhat different type of breathing than ordinarily employed on land. Several swimming writers have summarized some of the differences, although no evidence has been presented except "personal opinion" in solution to many of the perplexing problems encountered in this study. Many want to know why swimming causes such a prompt loss of breath for all except those who have thoroughly learned to adapt themselves to the water. Loss of breath seems to be much more rapid while swimming than during exercise on land. It is common to see athletes with excellent "wind" during exertions on land become quickly fatigued after a relatively short swim. Breath control in the water means not only the *timing* of the breath but also the regulation of *adequate ventilation* of the lungs for the work done.

Modern Crawl Strokes Present New Problem. Only a part of the

conclusions reached in this study actually depend upon original investigation. Physiologists have obtained some facts about breathing while swimming, but it is only too evident that important facts known in physiology have not as yet been generally applied by instructors and coaches. The modern crawl strokes have received little investigation in this respect. Particularly are the problems of breath control under racing conditions largely unsolved. Little attention has been given to the effect of the stroke movements themselves as either helping or inhibiting breathing. It is easy to become discouraged with the crawl strokes because breathing is so difficult for most people. However, more definite knowledge about the peculiarities of respiration may lead to some improvement.

THE METHODS OF INVESTIGATION

Apparatus for Graphical Records of the Respiratory Movements (see Illus. 1). Graphical records were secured of the respiratory movements as made by the thorax and abdomen by using the *Pneumograph*[1] (1), a tube to transmit the changes in air pressure within the instrument and a recording apparatus. The pneumograph was made of a hollow rubber tube encasing a spiral spring and arranged so as to be water-tight in all connections. Any changes in its length made by expansion or contraction of the thorax or abdomen while breathing would cause a change in the column of air in the tube. This was transmitted to the recording apparatus by a long, thick-walled tube (2). Such a type was used to resist the effect of water pressure and vibration on the air column within the tube. Registration was secured by means of a straw and writing point supported upon Marey's tambour (3) by a ball of wax. The tambour may be compared to a small drum made by stretching a thin sheet of rubber over the end of a small pipe. The changing pressure caused the alternate inflation and deflation of the drum, which in turn caused the straw to go up and down. On the end of the straw was a small and delicate writing point adjusted for minimum friction. One adjustment of this pointer was used for a series of graphs taken on a single subject. The graph or tracing was secured by adjusting the pointer to just touch the smoked drum (4) of the kymograph (5) as the drum was rotated at uniform speed by the clockwork. A chronometer was used to register graphically time intervals on the tracing. Numerous precautions were taken to prevent possible errors due to vibration of the long tube or poor adjustment of the recording apparatus. Movement of the pneumograph and tube through the water at speed did not affect the writing point.

Feature of Apparatus. An outstanding feature of the apparatus was the long tube, approximately 40 feet long, reaching from the pneumograph to the recording apparatus. With the kymograph placed about mid-way on the side of the pool the swimmer could swim up and down the length

[1] See for complete description of Marey's apparatus "Traite de Physique Biologique" vol. 1, Paris, 1901.

of the pool while a graphical record of respiration was registered continuously.

Position of Subjects and How Tested. With the apparatus as described subjects were tested in the lying position on land, floating in the water and swimming various strokes at different speeds. While swimming the position was always approximately horizontal. On land the subjects were tested on the back to free the pneumograph from pressure against the floor. Testing the subjects to determine the effects of simple immersion was done several times with each subject. On some subjects balls were used as artificial floats (6), but on others, and particularly the poor swimmers, it was necessary to test them with the feet on the bottom. The manner of entry into the water was relatively slow, but some splashing and motion of the water could not be helped.

Volume of Air Exchanges Measured (see Illus. II). The volume of air exchanges was measured by two methods:

1. Breathing in and out of a spirometer for a few breaths.
2. Gas meter.

These two methods were used as a check against each other. Approximately the same methods were used as in obtaining the graphical records regarding the position of the subjects and manner of entry into the water. Vital capacities were measured with the spirometer and were all taken in the standing position. Measurement of the volume exchanged while making the swimming movements was accomplished by holding the subject from the end of the springboard with a long strap placed about the hips.

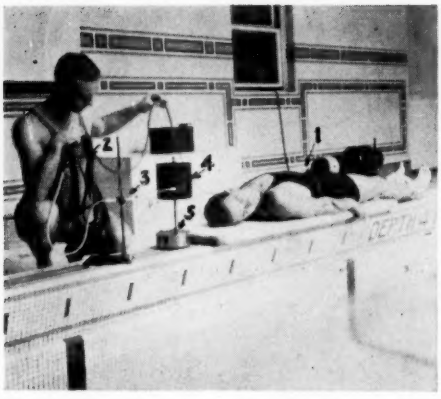
(1). The intake and exhaust tubes were held so that the arms would not strike them while making the swimming movements. Fresh air entered at the intake tube. (2), passed into the subject through a one-way valve in the mouthpiece (3) and after being inhaled was exhausted through a separate one-way valve leading to the outlet tube (4). This exhaust air was metered by passing through the gas meter (5). Dials on the front of the meter registered the total volume while the separate expirations could be seen on the dial inside the top of the meter when the cover was raised. The number of respirations was counted this way.

Speed Efficiency Tested by Stop Watch Time Trials. Stop watch time trials[2] were given to many swimmers as different kinds of respiration were used. In addition to time the number of breaths and strokes were counted for various distances.

EFFECT OF SIMPLE IMMERSION UPON THE RESPIRATION RESULTS

Resting State. Immersion of the body in the water caused definite interference with breathing. The most noticeable effect was the marked *irregularity* of the respiratory movements. (See Illus. III) In all cases

[2] See for complete details article "The Stop Watch Method for Testing the Efficiency of Speed Swimmers." Beach and Pool Mag., Chicago, Feb., 1930, by Cureton.



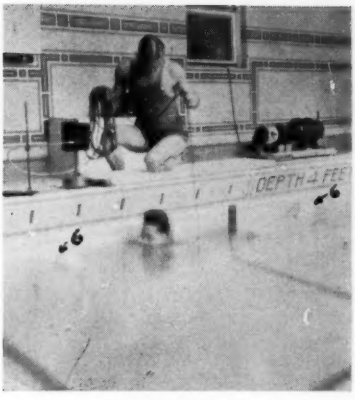


Illustration I

APPARATUS FOR RECORDING RESPIRATION WHILE SWIMMING

Key:

(1) Pneumograph.
(2) Long tube attached to the pneumograph on the swimmer and to the recording apparatus on land.
(3) Tambour and writing point.
(4) Smoked drum to record movements of the writing point.
(5) Kymograph consisting of clockwork and drum.
(6) Balls as artificial floats.

Illustration II

APPARATUS FOR MEASURING VOLUME OF AIR EXCHANGED WHILE SWIMMING

Key:

(1) Long strap to hold subject while swimming.
(2) Intake tube for fresh air.
(3) Mouthpiece commonly used with Douglas bag.
(4) Exhaust tube from subject.
(5) Gas meter with top raised.

both the rhythm and depth were changed, although it was evident that some individuals were affected more than others and that the temperature of the water, as well as the manner of entry, was important. However, the most irregular curves seemed to belong to the poor swimmers. There was a general tendency to *inspire and hold the breath* immediately after immersion in water of 22 degrees C. (71.6 F.). After the initial adjustment was over, the movements were still irregular but breathing on the whole was *faster* than on land. The graphical record shows a tendency to *breathe deeper* as well. Normal breathing on land was 12 to 16 times per minute and with the same subjects was 18 to 26 times per minute in the water. In most subjects the abdominal movements were more pronounced than those of the thorax. There was an average loss of vital capacity due to immersion of 6.12%. Typical results as measured are indicated in the following table:

TABLE SHOWING LOSS OF VITAL CAPACITY

Subject	Vital Capacity on land. (standing)	Vital Capacity in the Water. (standing)	Loss c.c.
K	5000 c.c.	4700 c.c.	300 c.c.
L	5600 c.c.	5300 c.c.	300 c.c.
He	4700 c.c.	4600 c.c.	100 c.c.
Ho	6000 c.c.	5400 c.c.	600 c.c.

Forced Breathing. Any irregularity or hesitancy seemed obviated during forced breathing. It did not seem to matter whether the breathing was forced voluntarily or the natural result due to exercise. The rate of artificially forced breathing on land at maximum speed and capacity was about 30 times per minute in several subjects and was approximately the same in the water. It was noticed that during forced respiration the thoracic movements were slightly greater than the abdominal, but in two good swimmers the latter were greater. The greatest change seemed to be in the *depth* of the respiration, this increasing from three to five times.

TABLE SHOWING TIDAL AIR ON LAND AND IN THE WATER

Type	Place	Subject F.	Subject H
Normal	In water	500 c.c.	600 c.c.
Normal	On land	450 c.c.	500 c.c.
Dyspneic (after four lengths crawl)	In water	1500 c.c.	1500 c.c.

DISCUSSION

Instructors seem to have a good basis for their common belief that breathing is interfered with by immersion in the water.

Reflex Effect Due to Cold. The first effect of the reflex due to cold is to cause an inspiration and tendency to hold the breath. Therefore, control of breathing is difficult, particularly with beginners, unless some method is used to warm them up first.

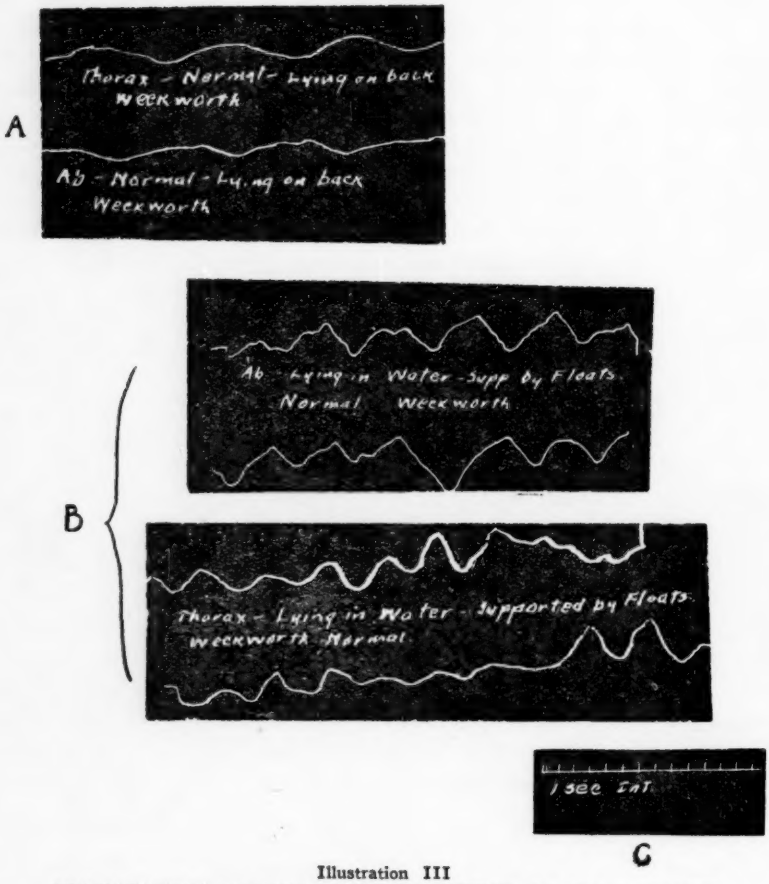


Illustration III
COMPARATIVE GRAPHS SHOWING EFFECT OF COLD WATER UPON THE RESPIRATION
Key:

A—is a graph of normal respiration on land lying on the back.
B—is a graph of the same subject taken 30 seconds after immersion in cold water (71.6F.).
C—is a graph of time intervals of one second to be used with these curves to determine the rate.

Fear May Be Related to Breath Control. Learning breath control is undoubtedly complicate by fear. It is reasonable to suppose that fear can be overcome by seeing that each beginner learns breath control before much is attempted with the swimming movements themselves. Fear is very plausibly caused by the constantly recurring thought that immergence in the water and attempting to swim means discomfort, choking or drowning.

First Breathing Drills on Land. Land exercises such as imitative rotary breathing, deep breathing, forceful exhalation, breath holding and practice at home blowing out the air into the water with the face submerged, should be very helpful in learning to control the breath and reduce the initial fear complex.

Warming-up Land Drills to Counteract the Inhibitory Effects of Cold Water. Warming-up land drills which result in a physiological increase of both circulation and respiration with some increase in body heat are very desirable but should not be continued to the point of fatigue. Kellogg[3] investigated this subject while studying the physiological effects of water upon the body. He describes in detail the effects of cold water upon the sensitive skin areas and mucous membranes and points out that a physiological warm-up as well as a quick entry accompanied by exercise immediately are very favorable to an easy adjustment to the water. Kappanyi and Dooley[4] investigated the inhibitory effects upon the respiration of water in contact with the nostrils of a muskrat. They found an almost immediate cessation of respiration and that the inhibition remained even after removal of the animal from the water. Martin Flack and Leonard Hill[5] discovered that it was more difficult to hold the breath in cold water than in warm. The average time for warm water was 42.5 seconds and 29.5 seconds for cold. It is a common observation that swimming land drills or rubbing are very helpful to counteract the effects of cold water.

Effect of Extra Water Pressure upon the Respiration. Speck[6] found that vital capacity decreased in proportion to the load which soldiers had to carry. In water it is evident that there is more pressure on both the abdomen and thorax and a law of physics states that this pressure is directly proportional to the depth under the water. This is undoubtedly a factor which tends to inhibit deep breathing and cause an earlier onset of respiratory fatigue. Some believe that this is the greatest factor affecting breathing in simple immergence or easy swimming with the head out of the water. A calculation shows that for a person with a breathing box area equal to 3.96 square feet and assuming that the mid-point of this area is 18 inches below the surface as in ordinary swimming, this extra pressure in total pounds equals about 371 pounds.[7] An additional computation shows that this is equivalent to an increase of 4.42% over atmospheric pressure at standard conditions.

Effect Greater on Untrained Persons. To people unaccustomed to this extra load, respiratory fatigue would come more quickly. That its effect would be greater on those who had not recently been swimming

[3] Kellogg, J. H., "Rational Hydrotherapy" Phila., 1901 pp. 110-133.
[4] Kappanyi and Dooley, Am. Jour. Phys., v 88, Feb-May, '29, p. 592.
[5] Flack and Hill, "Caisson Sickness," London, 1912, p. 4.
[6] Speck, "Military Hygiene" by Bischoff, Hoffman, Schwiening, in Russian, 1912, p. 328.
[7] An average of four subjects actually measured.

very much is supported both by practical experience and experimental evidence. It is a well known fact that respiratory strength differs greatly among individuals, depending somewhat upon age and training. Zuntz and Schumberg[8] found that the decrease in vital capacity after fatigue was greater among untrained than trained men. However, by practice, anyone may improve the respiratory strength and thus feel the effects of the extra water pressure less. The practical point to be emphasized is that inspiration is a real muscular effort, particularly when performed in the water. The inspiratory muscles, the diaphragm and the secondary muscles which lift the thorax, must be accustomed to harder work for efficiency and comfort in swimming. Training should consist of deep breathing, bobbing in deep water (6 feet), regular deep breathing while kicking the legs and fairly long swims.

Expiration Harder When the Face is in the Water. Expiration while immersed in the water would seem to be mechanically easier because the extra pressure on the thorax and abdomen adds to the other factors producing normal expiration, namely, the weight and elasticity of the chest, elasticity of the lungs, release of the compressed viscera and contraction of the intercostal muscles. The evidence shows that except at first deeper respiration does happen. It has been noticed that many beginners have difficulty breathing out when their faces are in the water. It is possible that inhibitory reflexes operate as Kappanyi and Dooley have demonstrated with the muskrat. In this case expiration must take place in opposition to their effect. Only by considerable practice can this difficulty be controlled. Drills which should be helpful are blowing bubbles with the face in the water, bobbing up and down, imitative rotary breathing with the face rolling into the water for expiration, face down glides with slow expiration.

RESPIRATION IN SWIMMING

How Respiration Differs While Swimming. Respiration in ordinary swimming is considerably different from respiration on land. In addition to the inhibitory effects of cold water, which interfere to some extent, particularly when the water comes in contact with the face, there is the

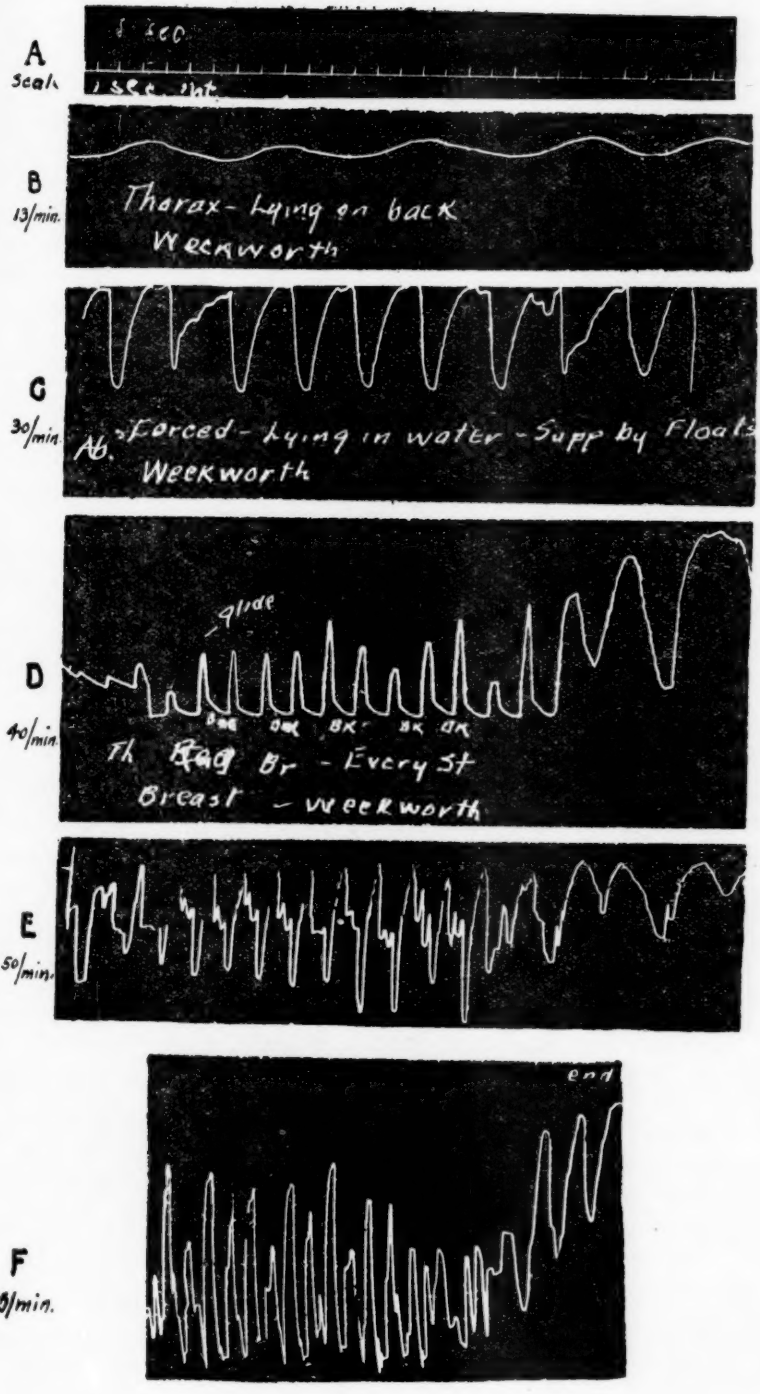
(See next page for illustration)

Illustration IV

COMPARATIVE GRAPHS SHOWING RATES OF RESPIRATION

A—Scale with time intervals of one second.
B—Normal breathing on land—13 times per minute.
C—Forced breathing lying in the water—30 times per minute.
D—Fast breaststroke—40 times per minute.
E—Fast crawl—50 times per minute.
F—Fast backstroke—75 times per minute.

[8] Zuntz and Schumburg, (see 6, p. 329).


A
Scale
1 sec. int.
B
13/min.
Thorax - Lying on back
Weekworth
C
30/min.
Ab.
Forced - Lying in water - Supp by Floats
Weekworth
D
40/min.
glide
Th Rag Br - Every St
Breast - Weekworth
E
50/min.
F
75/min.
end

added pressure on the body, some interference when expiration is made through the nose, due to the small size of the passage, and there is *marked interference due to the stroke movements themselves.* During exercise on land, breathing is largely governed by the needs of the body, being regulated chiefly by the percentage of CO_2 in the blood affecting the respiratory center.[9] So as to get all the air possible in a minimum of time, breathing during strenuous exercise on land is entirely through the mouth. On the other hand, while swimming and using the customary type of breathing as taught almost universally today, in through the mouth and out through the nose, respiration is greatly interfered with by adjustment to the stroke and also to the conditions of the water previously mentioned. The crawl stroke has been found to cause greater interference than many of the other strokes.

Rate of Breathing Faster in Swimming. (Illus. IV). It was found that breathing while swimming was usually performed at a faster rate than while exercising on land. For crawl swimming, under racing conditions and breathing once each cycle, the rate was 7 to 12 times per length of a 60-foot pool or about 35 to 60 times per minute. It was even faster in some cases, but the figures indicate an average performance. One observation on fast backstroke swimming recorded 15 times per length in 12 seconds, or the equivalent of 75 times per minute if maintained for one minute. The rate in the breaststroke under racing conditions registered about 15 breaths per length in 14 seconds, or about 60 times per minute. These rates may be compared with 30 times per minute or less measured on several runners after running vigorously for 1½ minutes. The fast rate of breathing prevalent in fast swimming has considerable to do with poor ventilation and early fatigue.

Swimming Type Breathing Is Shallow. The depth of each inspiration was considerably less during sprint swimming than in exercise on land.[10] The following table is typical of some of the observations made with the gas meter:

Type of Swimming	Time sec.	Dials rev.	Number of Inhalations	Rate of Breathing No.min.	Volume per Inhalation c.c.
Breaststroke	22	3	21	57.3	609
	30	6	31	62.0	890
Crawl	27	4	16	35.6	1150
	29	4	20	33.1	920
	34	5	25	44.2	921
	30	4	27	54.0	682

While normal exchange in the resting state was about 550 c.c., imitation of the swimming type of breathing at 60 times per minute gave

[9] Haldane, John Scott, "Organism and Environment as Illustrated by the Physiology of Breathing," Yale U. Press, 1917, pp. 1-26.

[10] Compare with liters of oxygen used per minute, see Evans, "Recent Advances in Physiology," Phila., 1926, p. 265.

an average result of only 300 c.c. for each breath. After swimming four lengths crawl, at medium speed, the volume increased to 1500 c.c. per respiration. These results show that as the rate of breathing became progressively faster in the crawl stroke, the volume decreased in like proportion. There seemed to be considerable interference with the depth of respiration as compared with vigorous exercise on land. The results also showed a difference between the crawl stroke and the breaststroke, namely, that as fatigue increases in the breaststroke type of swimming, there is an increase in volume per respiration, but in the crawl there was actually a decrease in the volume of each respiration as fatigue increased.

Interference Due to the Stroke Movements. (See Illust. V). Numerous experiments were made to determine what effect the leg action and arm action had upon respiration, and there is ample evidence to show that additional interference was introduced. The interference was greater in the crawl strokes than in the breast and side strokes. Depression of the arms against resistance in any of the stroke positions caused a lowering of vital capacity and less breath per inhalation. In this movement, fixation of the thorax was marked. Vigorous action of the legs caused fixation of the abdominal muscles, which also caused a lowering of vital capacity and volume of each inspiration. The pneumograms show this fixation clearly.

Time of Inspiratory Phase Cut Down. (See Illust. IV). A fact noticed in a study of some of the graphs was that the time for the inspiratory phase of respiration was cut down considerably in fast forced breathing and still more in all of the racing strokes. Normal breathing gave an approximate inspiratory phase 2.5 seconds long, fast forced breathing .8 seconds, breaststroke, .5 seconds, backstroke .4 seconds, and crawl, .2 seconds. The sidestroke gave an inspiratory phase practically as long as forced breathing without swimming. These figures were taken from the graphs of Illustration IV.

Swimmers Do Not Expire Fully. (See Illust. IV — D and F. Illust. V—D and E.). Another interesting fact found was that the subjects swam with their chests considerably inflated and that full expiration was not made. This in itself helps greatly to explain the findings of such low volume exchanges while swimming. It is obvious that an incomplete exhalation would limit the depth of the succeeding inspiration. Most of the graphs show this by jumping up to a higher level at the completion of the swim. Care was taken to maintain the same body position throughout.

Discussion. Beginners are taught to breathe *IN through the mouth and OUT through the nose* as their faces are partially or wholly submerged. This method is now being taught almost universally, probably due to inertia rather than to approval because of scientific experimentation.

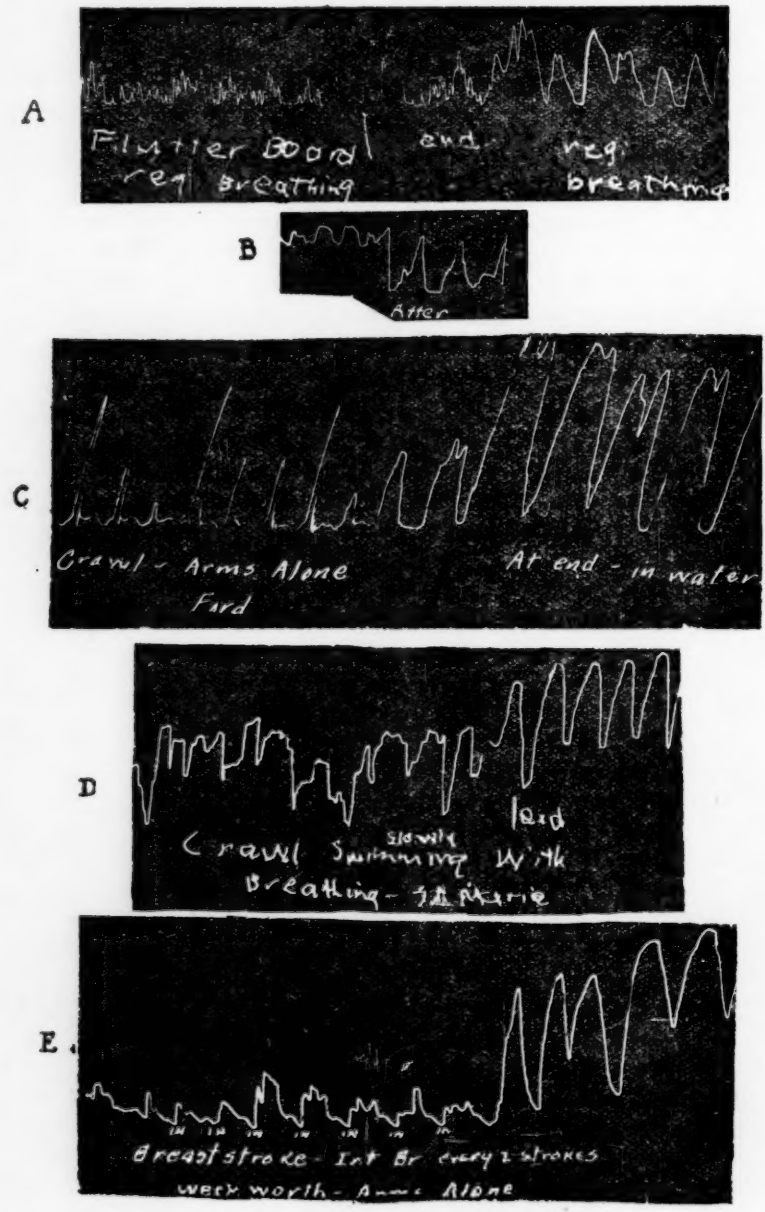


Illustration V

GRAPHS SHOWING INTERFERENCE WITH RESPIRATION DUE TO THE STROKE MOVEMENTS

A—Showing how the flutter kick action greatly inhibits breathing.
B—Showing inhibition due to a slower, wider flutter kick.
C—Showing inhibition due to arm action in the crawl.
D—Showing composite effect—very irregular and inadequate breathing.
E—Showing shallow breathing of fast breast stroke swimming followed by deep natural breathing at end of swim.

Can some modification be applied which works as well from the standpoint of breath control but improves the efficiency of ventilation?

Reasons for Inspiring Through the Mouth While Swimming. Breathing in through the mouth is undoubtedly better than breathing in through the nose. There are several good reasons for this:

1. The nasal passages are exceedingly sensitive to foreign particles, particularly water. Inspiring through the mouth eliminates largely the possibility of sucking droplets of water in through the nose. Water taken in the mouth is harmless as far as respiration is concerned, and may be forced out. Even if swallowed it can have little effect. It is an important fact that the velocity of air coming into the mouth is very much less than that coming in through the nose. Therefore, the tendency to suck water into the mouth is less than if the inspiration were made through the nose.

2. More air can be inhaled in a shorter time through the mouth than through the nose because the opening is larger. This difference is considerable because for circular orifices the volume is directly proportional to the square of the radii of the openings. In all cases there is considerable interference in forced inspiration or expiration through the nose. This is simply due to mechanical limitation.

Expiration Through Nose or Mouth? The reason usually given for breathing out into the water through the nose is that with each inspiration small droplets of water which may have collected in or about the nasal passages are blown away. It may be added that in ordinary breathing it is easier to force air out against the water pressure through a small opening than through a larger opening because the total force required is less. However, with the same expiratory force being available each time, a longer time would be required for the expiratory phase when the breath is forced out through the nose than through the mouth. Thus there are apparently two factors which must be considered, time and mechanical interference. Both of these affect the possible ventilation of the lungs. It was found that swimmers do not breathe out fully and the depth of the next inspiration is lessened because of this, for one thing. A solution may be to encourage partial exhalation through the mouth. Practically, this seems to work very well when timed so that the *first part of the air is exhaled in a large explosion through the mouth and followed by finishing through the nose.* This method should give better total ventilation of the lungs. Getting rid of the CO_2 is an important point. Only a part of the inability of a swimmer to get rid of the waste air can be explained by mechanical interference. Macleod,[11] in discussing the mechanics of respiration, states that after any exercise the air in the lungs after expiration is increased, and that is probably a physiological adaptation to give maximum aeration to the blood. The time element, however, is very important, because faster breathing may usually be associated with a decrease in volume and poor total ventilation. Bachrach[12] recommends that beginners be allowed to breathe entirely through the mouth. This

[11] Macleod, J. J. R., "Physiology and Biochemistry in Modern Medicine," St. Louis, 1927, p. 531.

[12] Bachrach, "Outline of Swimming," Chicago, 1924, p. 77.

would, of course, be all right when their heads are out of water. The point to be emphasized is that beginners should spend a great deal of time upon mastering the breathing fundamentals by constant practice of the land and water drills already mentioned.

RELATIONSHIP OF RESPIRATION TO SPEED EFFICIENCY

Faster Time with Fewer Breaths in Short Sprints. Time trials taken on many swimmers show conclusively that swimmers can swim faster for short distances without breathing regularly and that they become slower in direct proportion to the number of breaths taken. First, it was found that a swimmer could kick a length of the pool much faster without breathing than breathing quite a few times. A greater effort may be attained by allowing continual fixation of the abdominal muscles to aid in driving the legs. Then it was found that faster time could be made with the arms alone and with the legs strapped to a polo ball without breathing than with regular breathing. Many trials of swimmers with the whole stroke have given a preponderance of evidence that 20 and 40 yard distances may be swum faster without breathing at all. It may be practically better to advise one breath just before the turn on the 40 yard race. A few men will be found who can do as well by taking another breath about half way back. This was true for all types of racing swimming, the crawl, backstroke crawl and breaststroke. Practical advice for the 50 yard race would be to breathe once just before the turn and once on the way back.

Improved a Few 100 Yard Sprinters. It was demonstrated that swimmers could also increase their efficiency over a 100-yard course by taking fewer breaths. Some, however, did not have the capacity to hold their breaths long enough to produce better results. Two subjects who had been swimming in competition for six years, with their best times ever recorded about 60 seconds, improved remarkably after practicing this method on forty yards and then trying it for a full hundred by breathing once on the first lap, twice on the second, three on the third, four on the fourth and five on the fifth. In other words, the objective was simply to breathe as little as possible and concentrate upon the stroke movements for maximum power. One of these swimmers on the first trial with the new method did 100 yards in 56.0 seconds and the other 58.4 seconds. Breaststrokers also swam 100 yards faster, one improving from 1:26.6 to 1:21.6. In this style of swimming the subjects breathed every other stroke. Two backstrokers improved from 1:12.4 and 1:16.2 to 1:09.0 and 1:10.0, respectively. Later comparative trials were given over again so that there would be at least two of one kind and two of the other and all taken under the same conditions. Care was taken to use the same pool, same kind of backstroke technique in starts and turns and to hold the trials at the same time of day. The results were approximately the same.

Scientific Testing to Detect Individual Differences. It is recommended as a practical suggestion that individuals be tested by the Stop Watch Method[13] to determine how far they can use the sprinting type of breathing. Individuals differ in oxygen debt capacity.

Sprinting Crawl Tests. A short table is given below as a sample of the data collected:

Subject	Type Swimming	Distance	Breathing Every Cycle	Breathing 3 Times	No Breathing
N	Flutter Kick Alone	20 yds.	26.6″	24.6″	22.0″
Ha	Crawl Arms Alone	20 yds.	22 strokes 13.00″	23 strokes 12.6″	24 strokes 12.0″
L	Crawl Stroke	20 yds.	18 strokes 10.6″	19 strokes 10.4″	20 strokes 10.3″
H	Crawl Stroke	40 yds.	41 strokes 20.2″	43 strokes 19.9″	44 strokes 19.5″

Effect Upon Rhythm. In all about fifty subjects were tested, and the results are similar to those quoted in the table. An inspection of the table shows that there were fewer strokes when a breath was taken on each cycle. The fastest rhythm consistently occurred when there was no breathing. This was true in all styles of swimming, but some swimmers were not affected as much as others. Turning the head obviously slows the rhythm in most swimmers. If all strokes are pulled through and there are more per length of the tank, an increase in speed must be the result, as was the case.

Deep Breathing Before Sprinting Improves Efficiency. It has long been known in physiology that deep breathing just before a short severe effort enabled a greater release of energy and resulted in more work being done. Tests were given to about 20 swimmers to see if the effect was noticeable. In 75% of these cases slightly faster time was made after deep breathing. Typical results obtained were as follows for 40 yards:

Subject	No Deep Breathing	After Deep Breathing 2 Minutes
Har	19.9″	19.4″
Hu	20.2″	19.5″
Fi	20.6″	19.8″
Ho	20.0″	19.8″

On two of the 100 yard crawl trials the best time was made after similar breathing before starting. The two fastest backstroke trials recorded on two swimmers were after such breathing.[14]

Discussion. A fast rhythm is essential for very fast sprinting, and fewer breaths makes a faster rhythm possible. Before Weismuller prac-

[13] Cureton, T. K., "The Stop Watch Method for Testing the Efficiency of Speed Swimmers," Beach and Pool Mag., Feb. 1930.

[14] Flack and L. Hill, "Jour. Phys." 347, 40, 1910. "British Med. Jour.," Aug. 22, 1908.

tically all swimmers were sprinting by taking several strokes and then taking a breath. Due to the fact that the world follows a champion in style, the method advocated in many places now is to take a breath every stroke. There may be some individuals with necks so supple that they can turn them to breathe and not interfere with the rhythm of the stroke. Careful testing has demonstrated, however, that there are very few of these people and the best method for most people will prove to be intermittent breathing on all short races. Some swimmers have tried taking a breath every four strokes after the first length and have found it effective for races of 100 yards.

Power from the Abdominal Muscles. It was found that breathing greatly interfered with the leg drive. Ordinarily, the abdominal muscles are fixed in continual contraction during the fast action of the flutter kick. These muscles must relax to permit a deep breath or the breath is made with great effort. Every coach has noticed that some swimmers can kick a flutter board fast for about two lengths and then the power seems suddenly to cease. The reason for this is that forced breathing begins and it must be deep or the recovery process will not operate efficiently and after a short while terrific fatigue will set in. Just as soon as the abdominals relax to permit deep breathing, the power is lost, or a great part of it. The abdominal muscles are being used in the crawl stroke to contract, to reinforce the arm action, to reinforce the leg action, and yet at the same time deep breathing impels relaxation. Two different actions are required at the same time. Consequently, one of these must give in or both partly, with a loss of speed efficiency. In sprinting oxygen is needed for the recovery process after the race is over, but not during a distance as short as 20 or 40 yards.

Oxygen Debt. A. V. Hill[15] uses a term, "oxygen debt," to indicate one's capacity to use up the supply of oxygen in the body. He experimented at length upon track men and could actually predict the speed at which they could run a mile by measuring this capacity. He has compared the muscle to an "accumulator" which will liberate its energy until it has run down, and then must be recharged. Oxygen is not needed for the breakdown, but is essential for the recovery process. This is the factor which is increased during training; that is, the ability of a competitor to continue endurance exercises on his reserve.

Characteristics of Champions. Champions have remarkable ability in this respect as well as good mechanics, structural aptitude and the will to win. Good sprint swimmers are those who have power and apply it properly, regardless of breathing. On the other hand, endurance swimmers must recover as they swim and rely on a greater capacity for oxygen debt. Proper mechanics contribute to success, but are secondary to efficient respiration.

[15] Hill, A. V., "Muscular Activity," Baltimore, 1926, pp. 4—44.

Deep Breathing. Deep breathing before a race will aid if it is not overdone. Haldane warns that continued forced breathing may lead to cramps.[16] Deep breathing after a race will aid in the recovery process. Inhalation of oxygen will speed it still more.

Ventilation. It is surprising to find that faster breathing does not necessarily cause greater ventilation. In fact, the faster the swimmers breathed, the slower became their time for 100 yards. A marked falling off in efficiency resulted when they breathed as fast as possible. Deep breathing is absolutely essential for efficiency in the endurance swims. Long-distance runners practice regular, slow, deep breathing while racing. Haldane, Meakins and Priestly[17] showed that fast, shallow breathing was very ineffective for ventilating the lungs. A quotation from their work states:

> "Rapid respiration (20-60 times per minute and 250-350 c.c.) produces 'irritable heart,' a condition characterized by breathlessness, rapid pulse, fainting attacks, exhaustion, giddiness, lassitude, headache and irritability."

The conditions found in fast swimming compare almost exactly with these and is undoubtedly the reason why speed swimming is so exhausting for most people as compared with exercise on land. Slower but deeper respiration has been demonstrated by these workers to be much more effective for ventilation of the lungs. An interesting calculation shows that one deep breath of 1000 c.c. is the equivalent of six breaths of 300 c.c., although one of these volumes is only 3⅓ times as great as the other. A very much higher efficiency of ventilation goes with deeper breathing. This is due to the mixing of fresh air with the air already contained in the lungs in the dead space and residual air in the alveoli.[18]

Efficient Breathing in Endurance Races. The point of this discussion is to show that anything which interferes with deep respiration will limit endurance over the longer distances by making recovery impossible. If inadequate respiration is used and continued, the condition as described by Meakins, Haldane and Priestly will result. It is significant that the various inhibitions to deep breathing as described earlier must be counteracted as much as possible by proper timing of the respiration, a long enough inspiratory phase to get the air in and possibly an adjustment in stroke mechanics to permit some relaxation of the legs and abdominal muscles during inspiration. It has been suggested that it may be possible to breathe in and out quickly as the head is turned to one side. This is obviously cutting down the inspiratory phase still more and cannot prove efficient for adequate ventilation unless so much time is taken to breathe both in and out that it will interfere greatly with the rate of the arm movements.

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[16] Haldane, J. B. S., "Possible Worlds," N. Y., 1928, pp. 117-119.

[17] Haldane, Meakins and Priestly, "The Effects of Shallow Breathing," London Jour. Phys., V., 52, 1919, p. 433.

[18] Macleod, "Physiology and Biochemistry in Modern Medicine," St. Louis, 1927, p. 531.

Strokes Explained in Terms of Respiration. The crawl stroke is at present in its orthodox form suitable for the short distances only, although some swimmers can go farther with it than others, according to their efficiency of ventilation and oxygen debt capacity. Many of the modifications of the crawl are due to efforts to get deeper and longer breaths, hence a greater roll or missed beat in the kick. It is significant that the strokes which are used for longer distances, such as the trudgen, side and breast stroke, are strokes which permit breathing while the legs are practically idle. Comparative curves of the world records show that the breast stroke increases in efficiency as the distance increases and actually surpasses the backstroke after 440 yards. Some years ago J. Handy, of Chicago, was very successful with a legless crawl. His best times were over the middle-distance races and his endurance was remarkable. Any swimmer who has not tried it will be surprised to find that a vigorous armstroke can be kept up very much longer with less fatigue than the whole stroke with the legs working. Few, however, have the arm strength to depend upon them alone, as Handy did. Barney Kieran, the Australian, was supreme at distance swimming, using a peculiar "amble crawl" which was characterized by a very exaggerated roll with a longer time to breathe. The trudgen-crawl is simply an orthodox crawl adapted to longer distances by an exaggerated roll and partly relaxed legs at a time of inspiration. Observation has shown that the so-called major kicks in a crawl stroke come simultaneously with the rolls in the body and the rolling is caused by driving the arms down too deep or turning the head to breathe. Many swimmers have a single wider kick in their otherwise perfect crawl stroke. This will be found to come just as the head is turned sideways for the breath. Sprinters need a powerful kick, but must get it for short distances by sacrificing their breathing to some extent. The results of this study indicate that there is no good reason why they should not do this. Distance swimmers will profit by a study as to how to get a little longer inspiratory phase and how to breathe out a little faster and more completely than they do. More attention must be given the arms, because every indication is that it is the legs which kill if they are driven hard in a continuous flutter. Many of the greatest swimmers use unbalanced strokes of some kind and people marvel at what they can do with such poor form. After all, there may be a real point in the poor form of quite a few. Anyone who has watched Arne Borg swim is amazed at his poor form as compared to the orthodox crawl standard.

This paper is only a preliminary report, as much more investigation is needed upon other points bearing upon the problem. The writer wishes to acknowledge the patient help and inspiration received from Dr. P. V. Karpovich with this investigation; to Coaches R. J. H. Kiphuth at Yale and J. L. Rothacher at Springfield for coöperating with some of the testing, and to Dr. J. H. McCurdy and Mr. G. B. Affleck of the same college for offering helpful suggestions.

Adult and Student Leadership in Physical Education

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I

The modern view of education and the demand of the present day world have changed the conception of the teacher as a leader. He becomes today a person who "lives in the activities as well as the children."[1] President Hoover has said of the teacher: "The public school teacher cannot live apart; he cannot separate his teaching from his daily walk and conversation. He lives among his pupils during school hours and among them and their parents at all times. He is peculiarly a public character, under the most careful scrutiny of watchful and critical eyes. His office, like that of a minister of religion, demands of him an exceptional standard of conduct; and how rarely does a teacher fall below it, how seldom does a teacher figure in a sensational headline!... (Teaching) implies a wealth of character, of faith, of patience, of quiet confidence to achieve such a record as that... It attracts people with ideals and character who love young people and wish to serve the nation and race... It is what he (the teacher) is, and what he feels every day and every hour in the presence of those children that counts, and he 'doesn't need to talk of character'."[2]

Again, a description of the ideal teacher is found as follows: "For the state to select its finest personalities as the teachers of its children and to pour into their minds and hearts, through long and careful preparation, the richest of its treasures, that act is the conscious thought of humanity finding itself in the direction of its fulfillment."[3]

With this entirely new and yet wonderful and deeper conception of a teacher in mind, what are some of the qualifications which are necessary?

1. The teacher must be human. By the force of his own personality, though teaching prescribed work, he keeps it from becoming heavy and mechanical. He holds the interest of the pupils and is, himself, a vitalizing personality.
2. The teacher is a companion. The teacher as a disciplinarian fades. He is subordinated to the interests of his pupils and leads them through directing their thought and conduct, and not by acting as a tyrant and lord over them.
3. The teacher must be well equipped, technically and professionally, for the work he is to teach, and in general foundation work, as child growth and study and morals and ethics.

[1] C. W. Hetherington, School Program of Phys. Ed., P. 59, World Book Co., 1922.
[2] H. B. Wilson, Character Education, Childhood Education, Sept., 1926, Pp. 2-8.
[3] Char. Ed. Methods, The Iowa Plan, Char. Ed. Institute, Wash., D.C., P. 78

4. He must see in his teaching not narrow intellectual knowledge alone, but moral and ethical training as well. He must have a wide outlook and insight. He must see the school and the child as a whole and not part by part. He must correlate all into one large harmonious whole.[4]

5. "Training, experience, personality including ideals, enthusiasm, force, appearance, and bearing" are summed up as essential by J. F. Williams.[5]

So the teacher as leader must be ever mindful of the personality of the child and not dominate it by his own dynamic leadership and efficiency, and not deaden but rather lead forth the personality and efficiency of the child. Beware of the teacher who says, "I'll do it myself; it is easier than explaining to the child and having mistakes made that you have to right after him." This is the old type leader. Rather, the real leader must "get hold of the child's natural impulses and instincts and utilize them so that the child is carried to a higher plane of perception and judgment and equipped with more efficient habits, so that he has an enlarged and deepened consciousness and increased control of powers of action."[6]

What methods shall be used to develop leadership and followership in the child, in order to foster the right kind and amount of adult leadership so that the leadership and followership qualities inherent in physical education activities may be brought out? The whole problem of developing leadership is one of method and leading, so that the results are the development of qualities which either are favorable to citizenship or are detrimental. A few instances will make the situation seem more clear:

Dewey in his "Human Nature and Conduct" says: "Some habits involve the support of environing conditions, a society of some specific group of fellowmen is always accessory before and after the fact. Some activity proceeds from a man; then it sets up reactions in the surroundings; others approve, disapprove, protest, encourage, share and resent. Even letting a man alone is a definite response. Even admiration and imitation are complicities. Neutrality is non-existent. Conduct is always shared; this is the difference between it and a physiological process. It is not an ethical "ought" that conduct should be social. It *is* social, whether *good* or *bad*."[7]

Again, "The expressions of character or of morals may be good or bad, hence the development tends to be good or bad according to the leadership. The leader sets the standards. In no other activities does adult leadership have greater moral power. In this leadership, we have a laboratory method in moral education. It is a foundation method on which the more refining activities may build. Character and moral training, therefore, is an essential developmental objective of physical educa-

[4] Ibid., Pp. 41-2.

[5] J. F. Williams, Org. & Admin. of P. E., Pp. 95-8, Macmillan Co., 1923.

[6] J. Dewey, The School & Society, P. 58, Univ. of Chicago Press, Revised Edition, 1915.

[7] Dewey, Human Nature & Conduct, Pp. 16-17, Wood & Brownell, Source Book in Health and Physical Education, P. 280, MacMillan Co., 1925.

tion. It arises out of inherent nature of the activity. The quality traits developed depend on the leadership supplied by physical education. If there is self-subordination to a leader (and there frequently is), it may be to an extremely bad as well as to a noble leader. If there are loyalty and cooperation, they may be to a bad organization and in a bad cause as well as to the best of these. Character traits are exercised, but they are exercised for good or ill."[8]

Another statement of this situation is as follows: "The duty of education is to provide wise leadership and supervision during play periods—at least until such a time as the pupils are able to apply those ethical ideals which tend toward good citizenship."[9]

So the problem becomes one of the right kind of method used by the right type of adult leader, in order that the best and noblest of qualities may be developed.

Any playground leader is only too well aware of the opportunity at hand for the development of good or bad social conduct. There are two thousand youngsters on the playground—the majority of them strangers. Through the correct organization and method and selection of activities and groups, a democratic attitude may be created in the group. On the other hand, through poor leadership or unorganized play on the playground, gang spirit develops, and the character traits of a member of a gang, in its worst sense, are developed.

It is necessary to set up real life situations, and provide an environment which is typically the environment met in life, and then supervise and direct in such a way that the children will develop along moral and social lines—not along the unmoral and unsocial side.

Right away this brings up the controversy over transfer of training. This argument is truly out of place, for it is not transfer of training that takes place at all. What actually happens is the development of power through certain situations which is exactly the same kind of power to be used later in life in similar and other situations, i. e.: By abiding by the rules of a game of tag or football, a power to abide by rules is developed which is exactly the same kind of power necessary in abiding by rules of oratory in a senate debate or of business in the business world; or, by applying oneself diligently to a task—say a stunt—until is is mastered, one develops power which is exactly the same kind of power necessary to apply oneself to mastering a new method of procedure in the business world.

Again, play activity "values for adults are not in the carry over of the activity, but in the development resulting from the activity. They are part of nature's scheme of developing abilities which make it possible for children to enter into adult adjusted activities."[10] So, the power de-

[8] Hetherington, The Object of P. E., A. P. E. Review, Nov., 1922, P. 408, School Program in Physical Education, P. 29, World Book Co., 1922.

[9] Wood & Brownell, Source Book in Health & Physical Ed., P. 338, MacMillan & Co., 1925.

[10] C. W. Hetherington, School Prog. in P. E., P. 25, World Book Co., 1922.

veloped and not the transfer of it is the important thing. It is the constant accumulation of power acquired from the developmental activities of physical education that enable people to enter into adult adjusted activities, and as soon as adult adjusted activities are entered, exactly the same kind of power is developed again, which enables the adult to enter into more advanced adult adjusted activities, and so the process goes on and on. The whole problem, then, is one of setting up situations which afford opportunity for the child to enter in and develop the qualities needed in moral life.

By what methods is this done? Merely the broad basic principles of managerial organization will be considered here:

First of all, in order that the opportunity for leadership and followership qualities be produced, there must be a proper selection of activities which contain these qualities. There must be selection according to the natural interest of the group with which you are dealing, choosing activities that contain opportunities for the development of those qualities which are desired. Activities interesting to the child and in which he enters naturally become self-driving and the easiest development of character traits results. Variety is necessary, as children have many abilities which must be exercised and developed.

Not only the proper kind of activities, but the proper amount and direction of those selected activities must also be taken into consideration in the managerial organization of the leader training program.

In connection with selection of activities there must also be taken into consideration the time available, the facilities available, and the best possible program planned with the above in mind.

The importance of the adult leader, manager, or teacher, and the number of such leaders that are available must be considered in connection with the program.

Second, there must be a classification and selection, not only of activities, but of individuals with whom one is working as well. People must be classed as to sex, age, and organic capacity or motor ability, in order that a program best suited to the organic and physical development can be planned and when classified according to ability and sex, character and mental development can be better carried on. There are various types of such organization and classification and these will be discussed later.

Third, there must be, behind this program, an organization giving life responses where human beings mix with human beings as nearly as possible in life situations, in order that the power developed may be the same kind of power that is needed in meeting adult life situations. This is the end toward which these character traits of leadership and followship are being developed.

With these basic managerial principles of organization in mind, the more specific methods and types of teaching will be considered in order

that the qualities heretofore mentioned may best be brought out. What are the methods of leadership and teaching that may be utilized, and what are the results of each?

1. There may be a leadership of activities *alone*. By this is meant mere technical teaching, where the teacher or leader has a game or an exercise or a dance that must be taught in a certain way in a certain length of time, and no thought is given to the values contained in such work other than the physical or health value. Result: Organic development is most affected; moral character development least. Character development may be greatly affected but whether it is for good or bad, moral of immoral, is little considered by this method of leadership.

2. There may be a leadership of the moral values in activities. This is the method of leadership with which the teacher must concern himself. This means not only a teaching of the actual activity, but a leadership in all of the inherent development and conduct situations in connection with the activity, through which character traits, as has already been shown, are developed.

This again takes two forms:

a. The teaching method.

b. The method in establishing habits, interests, and ideals.

Several types of teaching come up as a means of bringing about the establishment of habits, interests, and ideals. These must be considered in order that one may judge the best method of procedure in their program to produce leadership and followship qualities.

1. The easiest method of teaching, and that which brings probably the least results is teaching by demonstration and mimicry. Here the pupil merely follows the example of the leader with little of any thought or effort on his own part. Obviously the chance for ethical development is small.

2. Next in the scale comes teaching by explanation. Here is more chance for development and initiative, but again the main bulk of the work rests on the adult leader.

3. Coaching the activity alone with little reference to conduct and inherent values of the activity is still a step higher, as the initiative now comes from the pupil

4. When, however, projects are set with coaching of the values connected with the project, and not the mere physical accomplishing of the project alone, then there occurs a method which brings with it the opportunities necessary if leadership and followership qualities are to be developed.

5. And in connection with the coaching and instruction of this higher type must come discussion and the thinking through of the problems and values that arise from the activities. Here must be a practice and guidance in activities that are interesting. By discussion of these activities and the addition of other activities, the interests arising in the activity change into habits, and from right habits, intelligence and moral judgment arise. So a method of guidance in the personal relationships through natural activities that are interesting and in connection with which there is a thinking element from the beginning, is set up, for in order to learn a skill, thinking is necessary. As this thinking process goes on, it becomes a thinking not alone of present but also of future situations and consequences, and by discussion this develops in the right and moral way. Thus habit, interest and intelligence all develop together. Without opportunity for practice of the activity, no habit is formed. The activities must be interesting, for interest and emotional exercise are the drives; and in order for this development to be of the highest type, coaching and discussion from the first are necessary so that the person may think through to the consequence and so that development of the right kind may result. This is just the everyday method of life.

So, it is necessary if our program is to be successful to have:

1. An organization of activities that the essential inherent qualities and conduct situations may be present, through and from which leadership and followership qualities are developed.
2. After the organization is set up, coaching and direction of the activity, not merely lectual coaching where the coach teaches merely the activity and strategy of the activity alone, but coaching of the right and wrong methods of behavior that are brought out by participation in the activity.
3. Discussion, arguing and thinking through of a problem, preferably class discussion, at the time of the problem, in order that correct habits, interests and intelligence may develop.

Discussion of methods of teaching would not be complete unless direct and indirect leadership were spoken of. Direct leadership is the teacher actually doing the teaching. Indirect leadership is the teacher setting up the opportunity for conduct situations and organizing children under their own leaders; then, by supervision, bringing out and leading their student leaders through the right and wrong methods of behavior. This also is the type of teaching which must be used if leadership followership development in the children is to be carried on in the most efficient way.

Methods in classification of groups might well be brought to mind at this time. They are:

1. Mass instruction where mass drill is given, individuals working alone, but there is little opportunity for emotional development here.
2. Instruction in large groups with members of each group working together, a method by which games or dances are usually taught. Here is more opportunity for development as spontaneity and interest are drives here.
3. Teaching in small sections, such as a squad organization with a student leader. This offers the best method of leadership and followership development.
4. Individual instruction which is a more ideal method of teaching for the individual development, but due to facilities and finances is rather an impossible set up, and so is used for only such work as individual and corrective work and in such sports as track and field work where group work cannot be carried on extensively. This type lacks, however, the socializing qualities of the last methods mentioned.

The teacher or adult leader throughout this whole program must remember that his or her influence and direction is the driving force as to the outcome of the children's practice in activities. Charles L. Hampton, Principal of Tomales High School in California, says: "The coach or director of Physical Education, by virtue of his or her position, has more influence upon the boys and girls, or the whole student body for that matter, than any other member of the faculty. If he is vulgar or addicted to bad habits, this evil influence will soon show its effects upon the student body. However, his influence can work a tremendous good if his character and habits are irreproachable and if he is a natural leader, capable of arousing enthusiasm and stimulating good sportsmanship."[11] A professor of ethics said, "In my

[11] Hampton, Teaching Good Citizenship through P.E., A.P.E.R.F., 1925, P. 77, Vol. 30, '77-9.

class room the students learn the theory of right living, but on the athletic field they put the theory into practice and form the habit of right living. A coach misses his great opportunity if he merely directs. He must lead. He must be a salesman, but he must have more to sell than mere technique of plays.... the truly successful coach will go with his men beyond the field of play. He will get into their hearts."[13]

Teachers must realize that "teaching means stimulating, directing, and encouraging the learner to build up a series of clear ideas that will function. Ideas are but means to an end; the end is conduct."[13] Teachers must help the child to be entirely independent of teaching. They must create as soon as possible self-directing individuals. A good teacher thus eliminates himself as soon as possible.

So important is adult leadership that teachers should be secured who know how to teach children in addition to teaching their subject, and it will be found that in the end, teachers available at low salaries and with little training and experience cost more than good teachers with higher salaries and more training and experience. They need a broad vision of the whole life needs of the average pupil and should train to meet these needs and not to merely train for teaching their own system of physical education. They should educate the public as well to the needs of children in modern conditions, and should above all embody in their own ability, personality, and character what they teach.[14] Then will the school perform its function, which, according to Miriam Van Waters is "First to give instruction, furnish tools for intellectual progress, to supply certain facts and motor abilities deemed important in modern life; second, it must develop emotional attitudes in the child that tend to make it socially minded, as we say, prepare for life, make a good citizen. The educated person must be able to live in a group without offense, do good team work and feel rightly toward other human beings. That is to say, school must furnish instruction and serve as a laboratory for training in social relationships."[15]

II

Now turn to the student side of the problem of leadership and see where there are opportunities for the development of leadership and followship through use of student leaders.

The best method to describe the use of student leaders is to describe rather in detail the program of student leadership which is in use at Montclair, N. J. This is the most carefully worked out and highly organized type of student leadership the writer has seen and studied.

[13] W. L. Hughes, A.P.E.R.N. '1925; 30:502-3, Observations concerning social and moral learnings in Athletics, MacMillan & Co., 1927.

[13] Bagley & Keith, Introd. to Teaching, Readings 372.

[14] McCurdy, A Program of P.E., A.P.E.R., June, 1925, Vol. 30:319-25.

[15] Miriam Van Waters, Youth in Conflict, Chapter III, P. 88, Republic Pub. Co., 1926.

Their physical education program consists of four parts:

1. Organized free play.
2. Mass mimetics and squad work.
3. Mass games.
4. Rhythmic work.

Usually only two of these phases are engaged in during one period of physical education.

In the organized free play periods, there are many small groups working, depending on the size of the class. Usually the first children dressed and on the floor for that day are the leaders. They choose their own activity and get out the apparatus necessary, and as the rest of the children come on the floor, they select the group with which they wish to play. If the group (usually 6 to 8 people) is filled, they must go elsewhere and play. There are two or three shifts during the play period and the children shift while the leaders remain the same.

In mimetics, the exercises are given by students. A different leader may be chosen to give each exercise, or the children may race to one spot and the first one there may give the exercise.

In squad work, each squad has its leader. He organizes the work and helps the group with suggestions, keeping them always on the go.

In mass games, more opportunity is presented for the leader to handle larger groups.

Little was done in student leadership in rhythmic work.

One of the big features in the program was the fact that with so many children having an opportunity to lead, they could see what determined a workable group and what qualities a follower as well as a leader should have, so that when their turn to be a follower came, they had had followship training as well as leadership training.

The program at Montclair starts in the first grade with one large group handled by the teacher; when accustomed to this, a large group handled by a pupil. Usually to get this takes half a year. As student leaders develop and the groups become accustomed to it, the group breaks into two groups, then three, each with a leader.

The next step is to select a class leader, usually appointed by the teacher, and have under her the group or squad leaders. Usually the class leader serves for one day at a time. The squads, however, usually stay the same for convenience for a period of time. The class leader starts the mass work and others follow. Then she has charge of timing the squad shifts, and as the children get older and have more experience, so their leadership and followership duties grow. One interesting feature is that at any time when a question arises during the program, the work stops and it is discussed and the good side brought out.

In Maywood, Illinois, a student leadership is worked out as follows: During the first week of each semester, the grade teachers appoint, in conference with the principal and subject to the approval of the recreation

supervisor, pupils who will serve in the Play Leaders Corps—one boy and girl from every room for each 12 pupils of each sex. This Corps meets one hour per week after school for instruction. The Recreation Supervisor appoints a Captain over each sex from every school, and a Lieutenant over each division. It is their duty to assist the teacher in recreation periods, to help the neighborhood in which they live to play. The actual program is carried out by these leaders. Their requirement is that "play leaders do not need to be athletes or gymnasts, but they should be able to hold the respect of their playmates. They must know the rules of the game and be able to teach them to others. They must be quick to obey and willing to serve."[36]

In Norristown, the girls and boys excelling in knowledge and skill in physical education are selected by the supervisor of physical education. These prospective leaders are then trained by the physical education director in games suitable for group play. They then go to different schools and teach games to schools, appoint leaders, and assist leaders in the school who will eventually take the place of the borrowed leader. The teacher is the supervisor.[37]

In West Commerce High School, Cleveland, Ohio, a great deal is done with leaders' groups. Two groups of leaders are organized, first the squad leaders group and second members of a special leaders group.

The squad leaders group is made up of groups of girls elected by the members of the classes and serving usually one month, when a new election is held. They get together once a month for special training in the month's work; manage their squad activities; score, officiate, care for equipment and keep attendance of their group; and assist members of their group in developing correct techniques.

The special leaderclass is made up of a group of girls chosen on basis of merit in physical, mental and personal qualities. It is a voluntary and permanent membership. Theory as well as practice of physical education is studied. At West Commerce the class is open to girls of the 11th and 12th grades, a written request for admission being necessary. These applications are handed to the physical director who has a personal conference with each applicant concerning the nature of the leaders group. Selection is made on the basis of actual fitness and not by vote. Usually the group is limited to 25 in number so that one instructor can easily handle it. In case of a vacancy a girl is admitted from the rank given here on the waiting list. To maintain membership a passing grade must be maintained in all subjects of the preceding semester and she must make satisfactory effort as a leader.

Each member of the group is assigned to assist in one regular physical education class and meets with it at every meeting. In addition one

[36] P. C. Oliver, Pupil Play Leaders, Playground 18:355, Sept., 1924.
[37] Norristown Plan, Playground 17:177, June, 1923, Group play under group leaders.

conference hour a week is held with the director of physical education. There is one group meeting a week and each girl assists with the after school activities at least one afternoon a week.

The general duties of the group include assisting the physical direction, i.e., with attendance, equipment and apparatus; and with squad leaders; assisting the students of the classes in their techniques and any other way needed; promoting a high ideal of sportsmanship throughout the school; occasional teaching of a class in absence of the instructor; assisting with after school coaching and officiating.

Mimeographed instructions for each leader are given out weekly and a chance for practice teaching occurs at the weekly meeting of the group. Theory is studied at this meeting and is discussed in the weekly conference of each girl with the instructor. At these weekly conferences criticisms and suggestions of the previous classes are given and assignment of new material for the next class meeting takes place.

In addition one big project a semester is carried on by the group. Successful projects in the past have been a baseball party, demonstration, mass athletic meet, and swimming meet.

The principal of the school tells of its worth when he says, "A leaders' group, which functions as the group does at this school, is without question a valuable addition to the program of any high school in which it is found, when a small group such as this unhesitatingly accepts such a measure of responsibility for genuine leadership, the entire school unconsciously catches their spirit.

"Our records show that a number of pupils have really found themselves after becoming members of this group. Scholarship and reliability seem to improve with length of service in the leaders group."[18]

Reilly in his "New Rational Athletics for Boys and Girls" advocates the training of the mass rather than the few, and urges squad division where squad leaders are elected and then squads of six to eight are chosen by the leaders. Each leader keeps records of the work of each member of the squad, sees that the squad works and doesn't fool all the time. Each squad has a definite activity to engage in, worked out by the organizer (teacher)."[19]

With these specific examples of student leadership in mind, where are there opportunities for student leadership in a school program of physical education?

1. In a free play period before class begins, such as Montclair has, where children organize into groups under a leader for participation in activity when they arrive on the floor. Leaders are decided upon by their arrival on the floor. The first few to arrive being the leaders. The number of leaders is decided on by the number of activities a class is permitted to engage in during free play period.
2. In squad organization.

[18] Paper presented at this annual meeting of N.A.A.F. Women's division, 1926, by Miss Elinor M. Schroeder.

[19] P. W. L. Cox, Creative Control, P. 116, Lippincott, 1927.

3. In games, as team captains.
4. As class captain.
5. As assistant teachers.
6. As officers in clubs in Gymnasium Clubs, Athletic Associations, leaders clubs, hiking clubs.
7. As assistants in office and with equipment, attendance, records.
8. As officials in games, managers.
9. Chairmen of committees for programs such as dances, field days, play days, pageants.
10. As neighborhood play promoters.
11. Taking charge of groups in exhibitions.
12. Organizing lunch period activities.
13. Locker room patrols to assist with baskets.
14. College girls sent out to coach and referee high school and church league teams.

Granted opportunity for the use of student leaders, how may they be selected?

1. By appointment by teacher or supervisor of physical education on the basis of (a) natural ability; (b) interest; (c) leadership potentialities; (d) need for development.
2. By election of the class.
3. By passing certain tests set and so being eligible to serve as a leader.
4. By signifying the desire to be one.
5. By taking turn, when everyone is to serve.

How may squad leaders be trained? This training may take place in various ways best adapted to the situation at hand. A few methods of training will be suggested here:

1. No extra training need be required but the natural leadership of the group enlisted and use made of spontaneous leadership.
2. Squad leaders meet once a week, two weeks, or month depending on the organization; and after school or during a club period for extra training.
3. Where there are two gymnasiums and assistants a double set of leaders may be chosen. The A group trains to lead the squad the coming week while the B group is doing the actual leading and vice versa.
4. A squad leader's training squad working at one end of the gymnasium or in a different room while the rest of the class engages in a group or mass activity under the leadership of one person might suit a different organization of physical education activities the better.
5. A "Leaders Club" found in so many schools is another method of leadership training. This club differs from the ordinary squad leader or class leader type of organization described in the fact that these girls are keenly interested in physical education, and so come for extra work and training and must pass certain tests and standards set for them, physically and mentally. So they may serve as assistant instructors, and the squad organization usually rounds up under them. This program is working very satisfactorily at McKinley High, Canton, Ohio, and West Commerce High, Cleveland, Ohio, Roosevelt Junior High School, Cleveland Heights, Ohio.

With various methods of training squad leaders, how may the squads be organized? Again there are various methods of selecting squads:

1. They may be organized according to neuromuscular ability and organic capacity. All persons of the same level being in one squad. Usually the leader is of the same level.

2. They may be organized according to the same level of capacity with a squad leader of a higher level leading them.
3. They may be organized heterogeneously with various levels in the same squad. This method of organization if it is to be truly educational in value calls for a more expert and careful planning of activities and of leadership.
4. They may be organized according to choice of the leader.
5. They may be organized according to height, might, etc.
6. They may be organized according to alphabet.
7. They may be organized according to appointment by the teacher.

In fact, almost any type of classification may be used with types 1, 4, and 7 being the most common methods of organization.

The next thing that follows is what activities can be conducted in squad organization? The answer is practically all forms of activities.

1. All forms of stunts and self-testing activities lend themselves to squad organization.
2. Elements of athletics and combative activities may best be practiced in squads.
3. Chasing and fleeing games and activities where one or two squads compete against other squads uses this type of organization.
4. Rhythmic and dramatic activities can also be carried on in squads where one squad comprises one group in a dance. Not a great deal has been done along this line but there is no reason why squads could not work advantageously here also.

Followership qualities can be developed better in groups than in mass work as the leader has more direct contact with the follower and can bring out the best of the followership qualities. Also with revolving leadership everyone has a chance to be both a leader and a follower, thus giving many that ordinarily would have no chance to lead an opportunity to develop one or two leadership qualities.

Leadership qualities can be developed better in groups than in mass work as there are many more opportunities for different people to lead; and many more activities available for leading activities with character forming situations embodied in them.

The child, then, in our modern program, has opportunities through properly organized physical education activities to enter into activities and duties connected with them to develop leadership qualities and followership qualities. Whether he does develop them depends largely on the adult leader and his influence and supervision of the group rather than on the teacher's own dynamic teaching ability. The teacher can not loaf in such a program, for he must plan an interesting program of activities, continually check up on the child leaders, teach patience and thoughtfulness to the "bossy" leader, bring out the weaker ones, help those who need help, and work for better methods and results than before.

The program discussed, then, to be successful, may be judged by the following: In judging leadership development:

1. Is the leader democratic? Does he mingle freely with and help all? Do all under him keep happy and busy? Does he urge and promote team work? Is he a good

companion, recognizing the good qualities in others and exhibiting them in himself? Is he tactful and kind?

2. Does he accept responsibility and inspire confidence in his group?

3. Does he keep his mind and energy intent on his group and task and not on himself, and see the task through?

4. Does he consider the future outcome and then apply himself to make the most of the opportunity at hand? Does he have pride in his and his companions' accomplishments and in his school?

5. Does he have initiative, and energy, and is he happy and not a "tell-tale" and a "grouch"?

6. Is he honest? Does he admit his mistakes, accept blame, remain impartial, and abhor dishonesty?

7. Is he courteous, loyal, obedient to authority and regulations, and does he have faith in his school, and do people have faith in him?

8. Is he capable of carrying on activities without supervision and of knowing the value of property he is using, or does he constantly have to be supervised?

In judging the development of followership:

1. Does he recognize and respect responsible leadership and value the leader's opinion?

2. Does he cooperate cheerfully with the group and on any task the leader sets for him?

3. Does he respect the rights of others, or is he selfish in his group? Does he respect past experience and profit by it?

4. Does he sacrifice self for the sake of the task?

5. Does he keep his temper, play fair, and not "squeal"?

With this criteria for judging leadership and followership, what are the underlying principles governing a leadership program as it has been discussed?

1. There must be an organization and classification of children according to age, capacity, and needs.

2. There must be an organization of activities to meet the above classification of children so that by engaging in the activities, opportunity to develop leadership and followership qualities arise, in order that the activities may be interesting and so self-directing.

3. There must be a teacher and supervisor to not only teach and coach the actual activity, but to coach and direct conduct in all of the inherent and conduct situations that arise in the activity.

4. There must be facilities at hand allowing children to engage in the activities.

5. There must be time for participation in order for habits to be formed, interests developed and moral intelligence and character qualities developed.

Finally a program of leadership and followership broad enough to fit changing environment and different equipment is suggested giving merely a skeleton which may be filled in by 1st grades through colleges.

1. An inventory of time, space, and equipment and teaching force must be taken.

2. An organization of children according to age, capacity and needs must be made.

3. An analysis of activities and their inherent and conduct situations must be made in order to select those activities which contain possibility for development of leadership and followership qualities.

4. There should be an instructional period in almost every lesson where actual

instruction is given by the teacher, probably in mass organization, as the teacher-pupil relationship and the feeling of being one of a large unit are valuable and cannot be obtained in a program of all squad or individual work. Also instruction of this type is often the easiest way in which to teach a technique.

5. There should be in every period a practice period where groups have opportunity to work under student leaders and so perfect what is learned in the instructional period, opportunity for leadership and followship development being great here.

6. There must be spontaneous or free play periods under a student leadership organization such as described at Montclair, or West Commerce High School, Cleveland, Ohio, under adult supervision, in order that the children may have opportunity for spontaneous selection of activity interesting to them and so, through keen interest, develop habits and moral intelligence and moral conduct.

7. Activities should be varied and of such a nature that both organization and activity will carry over into after-school hours, or, as Prof. Hetherington calls it, "fringe activities," so that there is positive development not only while in school but also after school hours. This holds true for an after school program and for activities in the neighborhood.

Such, then, is a skeleton of a successful program of leadership and followership development through physical education activities that may be made to fit almost any situation with the result that future citizens will come out of our educational program better able to carry on the work of the nation in public and private life due to the fact that their school training and experience has fitted them for executive positions (leaders) as well as developed such qualities as cooperation to enable them to work with others (followers) and to follow their leaders harmoniously.

What Constitutes a Good Football Team?

By Dr. G. W. Hartmann
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I. A Preliminary Statistical Analysis of Current Practices.

Early in December, 1928, a questionnaire pertaining to current football practices at various institutions was circulated among coaches distributed throughout the United States. The names of 140 coaches were selected at random from the enrolled membership of the Football Coaches Association so as to secure a reasonably wide sampling of opinion.

The questionnaire (which is described in detail below) consisted essentially of thirteen items, soliciting specific data from each college and an expression of preference concerning certain methods of football instruction and technique. The answers could be briefly and unhesitatingly given by simply encircling or underlining the relevant numbers or alternatives.

Approximately 95 replies were received by about the end of January, 1929, indicating considerable interest on the part of a goodly majority of the coaches in the projected survey. As usually happens, some of the replies were incomplete or unusable in some respect, so that the following results hold only for 87 institutions. The final responses include figures from the leading Eastern and Western universities, the Military and Naval Academies, and a noticeable sprinkling of smaller schools of all types.

The raw data were then treated with the purpose of solving the following problem: What characteristics constitute a successful football team? "Successful" was defined objectively by the winning of the major proportion of scheduled games. If the percentage of victories be known, theoretically one should be able to determine what relation this fact has to other facts such as the number and kind of candidates, amount of practice, etc. If the relationship is close, clearly some sort of cause-and-effect connection is present.

The data pertaining to the percentage of victories, which is our all-important criterion, were derived from the answers to the last item (No. 13) of the questionnaire. The item took this form:

What proportion of its games has your college won up to and including December 1? (Encircle the right number in lines I and II below)

I. Games played:		1	2	3	4	5	6	7	8	9	10	11	12 —
II. Games won:	0	1	2	3	4	5	6	7	8	9	10	11	12 —

The remaining twelve items of the questionnaire were matched, one by one, with this criterion, to see if any significant associations existed. The degree of this association can be expressed mathematically by a coefficient of correlation. Since correlations will appear rather often in this discussion, it may be best to explain just what they mean at this point. A positive correlation is represented by the relation existing between height and weight; that is, other things being equal, tall men will more often than not be heavier than shorter men; but even considering the exceptions, the correlation is about .50. A zero correlation means that only a chance connection obtains between two facts; for example, there is a zero correlation between a man's intelligence and the length of his nose. A negative correlation means that a large amount of one trait is accompanied by a small amount of another; thus, the lower the temperature, the larger the amount of space occupied by water (or ice), since freezing causes an expansion of this substance. The degree of correlation between two sets of facts may range all the way from plus 1.00 through 0 to minus 1.00, with most values lying between plus .50 and minus .50.

Not all data can be treated by this method, since the original material must be in some numerical form before it can be applied. Average records, however, often serve as useful supplementary material where an exact correlation cannot be computed.

From this point on we shall consider each item of the questionnaire in detail.

Item No. 1 inquired: How large a squad of candidates do you have to choose from? The size of the squads ranged from 25 to 150 (Notre Dame and Pittsburgh report the largest number). The average was 52; but in this case, it may be that the median gives a better value, viz. 47. The correlation between this fact and the per cent of victories is plus .26—this is, definitely positive—which means that even if we knew nothing else about a team, we would know that a large squad meant a genuine improvement in its chances of success. It is also clear, however, that this alone is inadequate to account for the victories, so we must examine the other elements as well.

Item No. 2 asked: What time do you start practice and how long does it last? Obviously, the responses here will only be correct to the nearest quarter of an hour, but even this rough measure suffices to show the wide diversity which exists. The time devoted to daily work-outs ranges from a minimum of one-half hour to a maximum of two and one-half hours. It is surprising at first to note that the correlation between this and victories is negative, viz.,—.07. This means that the amount of daily practice is no symptom of success; if anything, it means that the more successful teams do not drill as much as the less successful. A little reflection will show that an unskillful team will try to compensate by more work on fundamental plays, which a good team can dispense with. The average amount of daily practice here reported was 1.9 hours.

The 3rd item queried: What days in each week do you scrimmage during the months of September; October; November? The crude figures are of lesser interest here, so they have been converted into per cents in the following table, which indicates the per cent of teams which scrimmage on each week day during the three fall months:

TABLE I

	Mon.	Tues.	Wed.	Thu.	Fri.	Sat.
September percentage:	36	80	78	45	17	4
October percentage:	9	78	75	20	1	—
November percentage:	5	42	54	4	0	—

A better picture of the state of affairs may be derived from the graph of this table in *Appendix C* of this report. Apparently, Tuesdays and Wednesdays are the peak days for scrimmaging during September and October, but in November, Wednesday becomes the preferred time. Those teams which scrimmage on Fridays and Saturdays during September probably do not begin their games until October 1st.

Item No. 4 inquired: Does your team warm up or rest entirely the day before a game? Eighty per cent reported warming up; only 6 per cent rest; while 10 per cent employ a combination "depending on the circumstances"; 4 per cent did not reply to this question. There are too few cases opposed to warming up to justify running a correlation.

Item No. 5 asked: Do you have any practice in the Spring; and if so, for how many weeks? Two-thirds of the teams (58) answered yes; only one-third (29) said no. Those reporting spring practice sessions devoted from 2 to 8 weeks to this purpose, with a median of about 4 weeks. For the entire group the correlation between the amount of spring practice and per cent of games won was .21; this is a low positive figure, but it seems that a team using spring practice has a decided edge on one that goes without it.

The 6th item read: Do you have any football work in the winter; and if so, what type? This is an instructive item. Only 12 out of the 87 teams claim they have winter practice, which is distributed among them in the following forms:

3—Signals and fundamentals
2—Theory of football and coaching
2—Indoor individual work
1—Board talks
1—Regular practice (A Southern College)
1—Same as spring practice
1—Intramural games
1—Classwork for freshmen

The curious fact here is that these dozen teams appear to be highly successful, since they averaged 72% of victories as compared with an average of 60% for the other 75 teams. This difference cannot be explained by chance, since the biserial correlation (a special formula adapted to this peculiar case) between proportion of games won and having winter practice is .33—the largest positive connection we have as yet encountered. A minor difficulty in interpretation should be noted here; we do not know from the correlation alone whether a good team deliberately selected winter practice for itself, or whether the winter work is responsible for building a good team! By itself, the correlation tells you nothing about which is cause and which is effect—it simply informs one of the degree to which two things go together.

Item No. 7 was a compound inquiry with three sections: Do you require your men to rest for a specific time after practice before eating the evening meal? When is your evening meal usually served? Do you serve your biggest meal during football season at noon or in the evening?

Twenty-five per cent of the teams enforced a rest period after practice, and 75 per cent did not; the average number of victories of the former was 64 per cent and of the latter 59 per cent. Again, we do not know why there should be this slight

superiority with the resting group, but it appears to be a real enough difference, as the checked correlation is plus .16.

Sixty-nine per cent of the teams have their big meal evenings and only 6 per cent at noon; 25 per cent, however, said they had no control over this factor, as training tables were either forbidden or not feasible at their schools.

The most popular hour for the evening meal was 6:30, according to the following:

TABLE II

Hour of Service	6:00	6:30	7:00	7:30	8:00	Irregular
Per cent of Teams	13	50	16	5	1	15

The 8th question was: How many superior students, Phi Beta Kappa or otherwise distinguished from the average, do you usually get each year on your first two teams? (Use the average of the past three years as your basis.) The replies ranged all the way from 0 to 12, with an average at 4. The correlation here was barely positive .10, so that heretical as it may seem to some, the team with the largest ratio of scholars in the line and backfield has the most favorable chances. Apparently, classroom distinction and gridiron prowess are not so remote as many believe.

Item No. 9 asked: How many men do you have on your Coaching Staff? How many are graduates of your college; of other schools? This is a problem of peculiar concern to the personnel of the coaching profession as such. The number of coaches runs from 1 to 10 with 3 as the model or most frequently recurring value. A correlation of .09 is found between the size of the coaching staff and the per cent of games won; unquestionably, this is a very complex situation to analyze, but there seems to be some slight connection between the two. A more striking fact is that there appears to be a negative correlation of -.07 between the per cent of victories and the proportion of domestic coaches (that is, coaches who are employed by the college from which they graduated.) Apparently, a coach's reputation is much more readily made if he is engaged by some institution of which he is *not* an alumnus.

Item No. 10 inquired: In playing a game away from home, do you prefer: 1. To take the squad to the opposing team's city or stadium as early as possible so as to familiarize them with the setting; or 2. To reach the site of the game just the night before the event, avoiding contact as much as possible with either opponents or supporters? This is a topic which has aroused much heated controversy and evidently the only way to solve such a question is to follow the technique here employed. It appears that 31 per cent favor the first alternative, and 67 per cent the second; a few failed to answer. The significant thing here is that the proportion of victories for those teams favoring alternative 1 is 68 per cent; while the proportion for those favoring the second alternative is only 52 per cent. It would seem to be a wise procedure to give the players sufficient time to adjust themselves to the critical, and frequently altogether new, environment.

The 11th question asked: Does the coaching staff co-operate with other departments of the college faculty in the study and advancement of athletic skill? Name the departments. A few of the replies mentioned the department of physical education, but this was not considered as coming under the scope of the question which was intended to refer to the academic and administrative divisions of the college staff. Forty per cent state there is co-operation of some kind with the personnel office, the medical school, the department of home economics (for nutrition studies), education and psychology, etc. The bi-serial correlation here with proportion of victories was plus .11; inspection of the original data shows that this figure is considerably less reliable than some of those listed above. Although the trend is just noticeable, cooperativeness would seem to be a favorable factor in predicting success.

Item No. 12 requested: How many games away from home do you usually have on your schedule each season? How many big games on consecutive Saturdays do you play? What effect do you notice on your team after the second trip away? Do you notice any effect after the second big game?

The per cent of games played on foreign territory correlates *negatively* with the proportion of victories, viz. –.29. This is one of the most clear-cut results of the study. The team which travels around much is at a disadvantage as far as winning its games is concerned. One may say with some confidence that if a team wishes to win most of its games it should arrange a home schedule. The per cent of games played away from home varied from 5% to 87%, with an average of 44%. (Note: In a complete schedule for all teams, of course, 50% of the games would have to be played at home and half on competitors' fields—unless both travelled to a neutral field, which may explain why there is a disparity of 6%. Also, it may have been just chance that the 87 teams analyzed in this report travelled a little less than usual this year.)

The number of big games played on consecutive Saturdays is absolutely unrelated to success, as the correlation is .0001!—or about as near a chance connection as one can find. This factor seems to have absolutely nothing to do with a team's record. Four games constitute the median number of big contests in succession.

Answers to the two questions about the effect of the second big game and trip are contradictory, and it is doubtful whether they should be considered very seriously, because of the large subjective error introduced in estimating a team's condition. 71% claimed they noticed no effect after the second trip away; 21% reported weariness and ennui; 5% maintained the team was improved; and 4% said "it depends on the situation." On the other hand, 64% reported a noticeable effect after the second big game; but from the phrasing of the question and the nature of the replies, it is dubious whether a good or bad effect was meant, so I would recommend the rejection of this item as devoid of significance.

This completes our survey of the individual items, but the major task of drawing conclusions still remains. To bring order out of such a chaotic mass is no easy job. Most of the correlations are moderately positive, which means that some sort of connection exists. A general interpretation which I venture to offer is this: A TEAM IS SUCCESSFUL IN SO FAR AS IT LEARNS THE SCIENCE OF FOOTBALL BY DISTRIBUTING ITS INTERVALS OF PRACTICE RATHER THAN CONCENTRATING THEM. The evidence in support of this proposition is based on the correlation of victories with winter practice of .33; with spring practice of .21; and the inverse relation of –.07 with amount of daily practice. Extending the learning series avoids the bad effects of something analogous to "cramming," because it allows time for the new plays to "soak in," avoids fatigue, and is more efficient because practice ceases before the law of diminishing returns begins to operate.

Another conclusion to be noted is that it is possible by means of the mathematical device of partial and multiple correlation to piece together all the numerous smaller correlations obtained above and obtain a joint prediction based on a combination of factors which will be more accurate

than any one taken singly. This method has been followed here, so that IT IS POSSIBLE TO PREDICT THE MOST PROBABLE PER CENT OF VICTORIES OF A TEAM, IF WE KNOW THE SIZE OF ITS SQUAD, IF IT ENGAGES IN WINTER PRACTICE, THE NUMBER OF WEEKS OF SPRING PRACTICE IT HAS, AND THE PER CENT OF HOME GAMES IT SCHEDULES. By this procedure, the multiple correlation, $R_{1(2345)}$ turns out to be .41, which is higher than any correlation taken singly. Expressing it rather roughly, a coefficient of plus .41 means that one would be right in foretelling success on the basis of these known factors in about 76 cases out of 100 (derived from a table of equivalents—or approximately 3 times in 4 guesses.) If we have absolute certainty, we would be right 4 times out of 4; when we just take a chance guess, we would be right 2 times out of 4; so that a prediction based on the outcome of this study would be about half-way between chance and certainty. It is obvious that the probability of error is still rather sizeable; but if one wishes to be optimistic the marked improvement over a chance estimate should be emphasized. A stock market gambler who could be right 3 out of 4 times would amass a fortune in a short period.

A final word of caution is in order. A little reflection will show that not all the data which might conceivably contribute to football success was asked for or represented in the original questionnaire. If these were known, the multiple correlation, instead of being .41, might jump to .71. To discover these factors further analysis and investigation will be necessary. It is recommended that a follow-up study similar to this be repeated annually so as to eliminate the effect of temporary fluctuations. An annual census containing suggested newer items is highly desirable, and it should not be difficult to convince the coaching profession of its value. As a profession matures it accumulates a body of knowledge much more refined than "rule of thumb" method; and since coaching is in the long run nothing but a special form of educational technique, there is no reason why it should not adopt the research policies which have proven so fruitful in other fields.

APPENDIX A—QUESTIONNAIRE FOR THE FOOTBALL COACHES ASSOCIATION

Please make your answers as accurate as possible. Additional comments may be made on the back of sheet. Encircle nearest number and proper answer to each question.

1. How large a squad of candidates do you have to choose from?
   20 25 30 35 40 45 50 60 70 80 90 100 or .....
2. What time do you usually start practice and how long does it last?
   2:00 2:30 3:00 3:30 4:00 4:30 5:00 5:30 6:00 6:30 7:00
3. What days in each week do you scrimmage during the months of September?
   M T W Th F October M T W Th F November M T W Th F
4. Does your team warm up or rest entirely day before a game? Warm up? Rest?
5. Do you have any practice in the spring? Yes. No.
   If YES how many weeks? 2 3 4 5 6 7 8 weeks.

6. Do you have any football work in the winter? Yes. No.
   If so, what type? .....
7. Do you require your men to rest for a specific time after practice before eating the evening meal? Yes. No.
   When is your evening meal usually served? 5:30 6:00 6:30 7:00 7:30 8:00
   When do you serve your biggest meal during football season? Evening? Noon?
8. How many superior students—Phi Beta Kappa or otherwise distinguished from the average—do you usually get each year on your first two teams? (Use past three years as the basis) 1 2 3 4 5 6 7 8 9 10 11 .....
9. How many men do you have on your Coaching Staff? (Include head coach and Ass'ts.)
   1 2 3 4 5 6 7 8 9 10 11 .....
   No. who are graduates of your school? 1 2 3 4 5 6 7 8 9 10 11 .....
   No. who are graduates of other schools? 1 2 3 4 5 6 7 8 9 10 11 .....
10. In playing a game away from home, do you prefer (encircle I or II):
    I. To take the squad to the opposing team's city or stadium as early as possible so as to familiarize them with the setting; or
    II. To reach the site of the game just the night before the event, avoiding contact as much as possible with either opponents or supporters?
11. Does the coaching staff co-operate with other departments of the college faculty in the study and advancement of athletic skill? **Yes. No.**
    Name departments .....
12. How many big games on consecutive Saturdays do you play? 1 2 3 4 5 6 7
    Do you notice any effect on your team after the second big game? Yes. No.
    How many games away from home do you usually have on your schedule each season?
    1 2 3 4 5 6 .....
    What effect if any do you notice on your team after the second trip away from home?
    .....
13. What proportion of its games has your college won up to and including December 1? (Encircle right number in lines I and II below)
    I. Games won: 0 1 2 3 4 5 6 7 8 9 10 11 12 .....
    II. Games played: 1 2 3 4 5 6 7 8 9 10 11 12 .....
    Signed: Head Coach .....
    College or Univ. .....

(Place in enclosed stamped envelope and return to Coach Hugo Bezdek, Penna. State College, State College, Pa.)

APPENDIX B

TABULAR SUMMARY OF RESULTS

The findings of this study have been condensed below. The number designation of each section refers to the corresponding item of the original questionnaire. The figures are based on the usable returns from 87 institutions. The r stands for the correlation, the size and direction of which tells one how closely each item is connected with a team's *success* as measured by the *percentage of victories during the season.* The statements accompanying each item are all reasonable interpretations of the data.

	Lower Limit	Upper Limit	Average	r
1. Size of squad reported:	25	150	52 men	.26

It would seem that a large number of candidates improved a team's chances of success.

	Lower Limit	Upper Limit	Average	r
2. Length of Daily Practice:	½ hr.	2½	1.9	-.07

Apparently successful teams do not drill as much as the unsuccessful.

3. Scrimmage Days in Fall: Table below gives per cent of teams using each day.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
September percentage	36	80	78	45	17	4
October percentage	9	78	75	20	1	—
November percentage	5	42	54	4	0	—

Obviously, Tuesday and Wednesday are the peak days for scrimmaging during Sept. and Oct., with Wednesday definitely preferred for November.

4. Warming Up or Resting Day Before Game (not a significant item):

Warm Up	Rest	"Dependent" Combination	No Reply
80 per cent	6 per cent	10 per cent	4 per cent

5. Teams with Spring Practice—67 per cent.
Teams without Spring Practice—33 per cent.

For Teams with Spring Practice:

Lower Limit	Upper Limit	Average	r
2 wks.	8 wks.	4 wks.	.21

This implies that a team using spring practice has a decided edge on one that goes without it.

6. Teams with Winter Practice, 14 per cent; average per cent of victories, 72.
Teams without Winter Practice, 86 per cent; average per cent of victories, 60.
r—.33.

Having Winter Practice is a decided advantage.

7. Teams enforcing Rest Period after Practice, 25 per cent; av. per cent of victories, 64.
Teams without any such enforcement, 75 per cent; av. per cent of victories, 59.
r—.16.

It seems to be a good policy to have some such rest period.

Teams with big meal evenings—69 per cent.
Teams with big meal at noon—6 per cent.
Teams without any control—25 per cent.

The most popular hour for the evening meal was 6:30, according to the following table:

Hour of Service	6:00	6:30	7:00	7:30	8:00	Irregular
Per cent of Teams	13	50	16	5	1	15

8. Number of Superior Students:

Lower Limit	Upper Limit	Average	r
0	12	4	.10

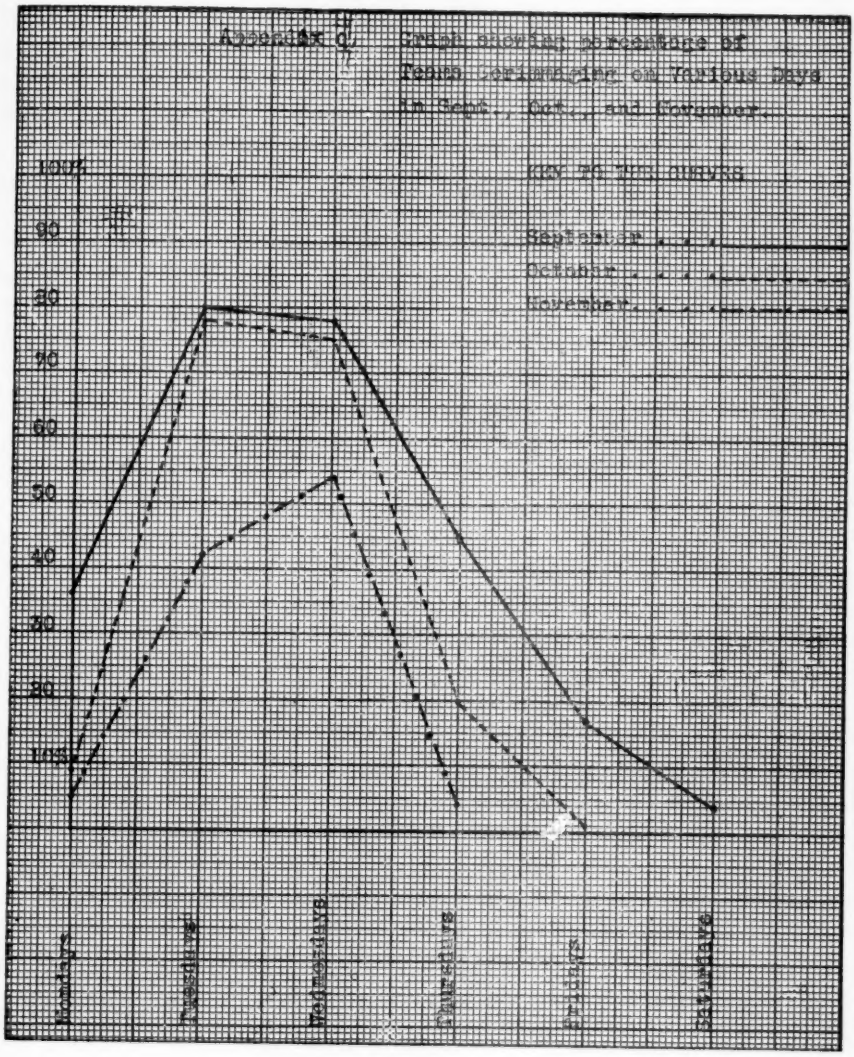
The team with the largest proportion of bright men has a slight edge on any other.

9. Number of Coaches:

Lower Limit	Upper Limit	Average	r
1	10	3	.09

A large coaching staff is a help, provided a majority of them come from other colleges, as there is a negative correlation of -.07 between the number of games won and the proportion of domestic coaches.

10. (1) Per cent of Teams which prefer to take the squad to the opponent's city as early as possible so as to familiarize them with the setting—31.


Appendix Q
Graph showing percentage of Teams retained on various days in Sept., Oct., and November.
100%
90
80
70
60
50
40
30
20
10%
September . . . .
October . . . .
November . . . .
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

APPENDIX B *(Continued)*

(II) Per cent of Teams which prefer to reach the site of the game just the night before the event, avoiding contact with everybody—68.
Per cent of Victories for Teams favoring Alternative I—68.
Per cent of Victories for Teams favoring Alternative II—52.

In spite of the fact that more coaches favor the second policy, the results indicate that it is generally wiser to adopt the first.

11. Teams which cooperate with other College Departments—40 per cent.
Teams which do not cooperate with other College Departments—60 per cent.
r—.11.

Cooperativeness appears to be a favorable factor in predicting success.

	Lower Limit	Upper Limit	Average	r
12. Games away from home:	5 per cent	87 per cent	44 per cent	-.29

It is a decided disadvantage for a team to do much travelling.

PRINCIPAL CONCLUSIONS

1. A team is successful in so far as it learns the science of football by distributing its intervals of practice rather than concentrating them.
(for supporting evidence, see items No. 2, 5, and 6).
2. It is possible to predict roughly the most likely number of games a team will win, if we know the size of its squad, whether it engages in winter practice, the number of weeks of spring practice it has ,and the proportion of home games it schedules.
3. Extreme caution is necessary in applying these findings. An additional follow-up study will be required to confirm them.

APPENDIX D

Summary of the Correlation Coefficients obtained between the per cent of victories and other factors pertaining to a Team (N=87). The Probable Errors are .06 where r is greater than .20; and .07 where r is less than .20.

*1. Size of Squad .26
2. Amount of Daily Practice -.07
*3. No. of Weeks for Spring Practice .21
*4. Winter Practice .33
5. Rest Before Eating .16
6. No. of Superior Students .10
7. Size of Coaching Staff .09
8. Per cent of Domestic Coaches -.07
9. Cooperation with other Departments .11
*10. Per cent of Games Away from Home -.29
11. No. of Successive Big Games .0001

* Indicates Variables used to compute Multiple Correlation, which turned out to be plus .41

BOOK REVIEWS

OUTDOOR BASEBALL. In Athletic Activities for Women and Girls. Spalding Series. 25 cents.

The outdoor baseball rules for women and girls have been incorporated into a separate book of the Spalding Athletic Library Series. It includes a separate detachable pocket size book of the rules, besides a large chart of the rules with ten pictures illustrating different points of technic. There are many interesting as well as instructive articles, such as "Baseball Etiquette" and "Why Are There Different Baseball Rules?" besides several other articles on coaching hints and organization for class instruction. There is also a chart comparing the main differences in rules for men's official league ball, girls' official outdoor baseball, official indoor baseball, and official playground ball. Any teacher of girls' outdoor baseball will find this an almost complete textbook.

Miriam Wagner,
Instructor, University of Nebraska

A HANDBOOK OF BASKETBALL FOR WOMEN. By the National Committee on Women's Basketball, Eline von Borries, Chairman.

This is a small pamphlet meant to serve as a supplement to the "Official Basketball Guide for Women." As Miss von Borries says in the foreword, the pamphlet has tried to give helpful suggestions for "every type of organization apt to promote basketball"— "The articles are written very simply and in such a way that the pamphlet may be of value not only to the already trained person, but also to the one untrained in physical education." There is an excellent section devoted to coaching hints on the technic and tactics of basketball written by Carol M. Rice of the University of Wisconsin. Any teacher or coach of basketball for women will find that this pamphlet helps them to know not only what standards they should maintain in their coaching of the game, but also gives them suggestions as to how these standards may be achieved.

Miriam Wagner,
Instructor, University of Nebraska

BASKETBALL—*A Textbook for Coaches, Players, Recreation Leaders, Students, and Teachers of Physical Education,* by James G. Bliss, Ph.D. Lea and Febiger. $2.50.

This treatise on basketball is unique and is a real contribution in this field. The treatise is unique because of the fact that it incorporates the educational point of view throughout. The treatise shows that educational method is just as important and as applicable in the teaching of sport as in any subject of the curriculum.

All phases of material presented are correct and up-to-date. Chapters I, II, and III, are pertinent and to the point. Chapters II and III especially present suggestions on training and injuries which should be deeply appreciated by all teachers and coaches. Chapter IV, on methods of practice, presents effective methods for both the individual and the small squad, and also brings out many of the natural movements of basketball through mass instruction.

Chapters V, VI, VII, and VIII deal with passing, shooting, dribbling, and starts, stops, and turns. Each one of these phases is presented clearly and concisely.

Individual qualifications and position play have been very completely covered in Chapter IX, bringing out all cardinal principles. Chapter X deals with offensive play, analyzing various types and their effectiveness. Special types of floor offense are suggested with illustrations. Center tip-off plays and out-of-bounds plays are also covered. Various methods

are suggested in putting the ball in play on various parts of the court after foul tries and held balls. Chapter XI deals exclusively with diagram plays.

Chapter XII deals with team defense, shows the importance of complete unity of action on the part of all five players, brings out various defensive methods, and suggests practice on defensive methods during scrimmage. All methods are carefully analyzed and supported by illustrations. Special defensive methods are also suggested for specific types of attack, and to meet the situation on free tries by opponents and on held balls. Chapter XIII suggests methods and means of scientifically measuring individual and team progress.

All material is sound, well assembled, and well illustrated, and the methods are clear and follow educational procedure. This text should be in great demand.

Guy S. Lowman,
Professor of Physical Education,
University of Wisconsin

THE THEORY AND TECHNIQUE OF WOMEN'S BASKETBALL, by Marjorie E. Fish, Director of Health and Physical Education, State Normal School, Danbury, Conn. Published by D. C. Heath and Company, Chicago. Price, $1.68. 1929.

In "Theory and Technique of Women's Basketball," Miss Marjorie Fish has presented in a very practical way material on principles, methods, and organization and has treated the numerous phases of technique in a most comprehensive manner. The material is well organized and presented in such a way that it will be equally helpful to the experienced and well trained coach and to the person who has not had the opportunity for intensive training. The inclusion of preliminary activity material, the diagrams and illustrations of certain points of technique, and the clear analysis of different types of play will be particularly helpful to the inexperienced coach.

The author has succeeded well in her attempt to treat the subject as an educational activity. Among the splendid features which contribute to this success are the suggestions with reference to the responsibilities and the influence of the coach and of the officials of the game. This very important phase has been too often neglected and in consequence the game has lost much of its value. An appreciation of the emphasis upon this point should result in much needed improvement in the attainment of worthwhile results.

Miss Fish, in her treatment of the subject, has made a fine contribution to the field of physical education and has emphasized in a very constructive way the values that may be obtained when the activity is conducted on an educational basis.

Miss Lera Curtis,
State Department of Health and Physical Education, Lansing, Michigan.

CAMPING AND CHARACTER. Hedley S. Dimock, Ph.D., Professor of Education, Y. M. C. A. College, Chicago. Charles E. Hendry, M.A., Supervisor of Field Work, Boys' Club Study, New York University. With a Foreword by Dr. William H. Kilpatrick. Association Press, 347 Madison Ave., New York. 400 pages. Cloth. $3.50 per copy.

The organized summer camp has passed the stage where it is to be regarded merely as a recreational agency, or as a "parking place" for the children of parents who wish to be rid of the responsibility for their care for a few weeks.

It is beginning to be realized that the summer camp has hitherto unrealized possibilities as a means of securing desirable results in the direction of positive character training, in addition to its tacitly assumed values in promoting courage, self-reliance, initiative, better health habits and appreciation of the beauties of nature.

This volume is the result of a seriously conceived and carefully directed effort to "analyze the procedure, expound the philosophy and evaluate the results of the summer camp, in the way of character training, and the development of socially desirable attitudes, ideals and habits."

The authors spent five seasons as staff members in a well-known private camp for boys. They were therefore able to gather at first hand the data on which their conclusions rest. They are among the first, if not the very first workers in

this field, to apply objective methods, based on records compiled from frequent behavior observation reports, to the study of problems of behavior and adjustment to environment. Their study of problem cases will prove particularly helpful to parents and teachers, as well as to camp directors and counsellors. The suggestion that the progressive camp of the future will include in its staff personnel a specialist in behavior problems will have the hearty approval of the mental hygienist and sociologist.

The chapters on "Co-operative Participation and Government" and "Social Controls in the Camp" will be especially challenging to the camp director who takes pride in a type of organization and control that is military, almost machine-like, in its precision. The statement of the authors that "we have about reached the conclusion that the more smoothly the program is run, the more negligible is the character output of the camp," will be particularly apt to provoke thoughtful discussion.

In the chapter on "Campcraft Skills and Character Growth" is a discussion of the problems of artificial awards and incentives. In this particular camp the giving of medals and cups had become so common that directors and counsellors had begun to question their value. A careful consideration of the underlying educational philosophy led to the abandonment of all awards based on the principle of competitive activities.

Other chapter headings are: The Educational Opportunity of the Summer Camp; Objectives of the Summer Camp; Camp Life as the Curriculum; Group Enterprises and Character Growth; Creating Desires for Higher Values; An Experimental Approach to Behavior Adjustment; The Training and Supervision of Leadership; Appraising the Results of the Summer Camp; Current Trends and Problems in the Camp Movement.

The appendix contains an excellent bibliography of over one hundred and twenty titles and a list of topics for study and discussion for leadership groups conducted by colleges and universities as well as in camps themselves.

Also are shown the various forms used in making the study, such as "Camper's Analysis and Rating," "Information from Parents," "Counsellors' Ratings," "Behavior Frequency Scale," "Behavior Observation Record," and others.

Camp directors, sociologists, psychologists, teachers, parents, all are indebted to the authors of this, one of the most significant contributions to educational literature in recent years.

P. B. Samson, President
The Great Lakes Inter-Camp Council; Professor of Physical Education, Michigan State Normal College, Ypsilanti.

THE BOYS' BOOK OF CAMP LIFE. Elon Jessup. E. P. Dutton and Company, New York. 300 pages. Cloth.

Now that the lure of the "open road" is attracting people literally by the million, this book, written by an acknowledged authority on outdoor life, is especially timely.

The author has drawn upon his long experience as an outdoorsman and has compiled a valuable mass of information which should prove of the greatest practical value to campers, explorers, and woodsmen.

Every phase of the practical details of camping and life in the open is admirably described. Chief emphasis is on the equipment of the shifting rather than on the permanent type of camp.

Information is given on every known type of tent, as to the endless variety of shapes and materials, with a discussion as to the purposes to which the different types are best adapted. The handy man who likes to "make his own" will find a wealth of practical suggestion in the chapter on "Tent Making and Waterproofing."

Comfort and safety are emphasized throughout, particularly in the sections devoted to "Sleeping in the Open" and "Feet and Foot Gear."

Tenderfoot and old-timer alike will do well to heed the precautions necessary in choosing the camp-site.

The chapters on "Maps and Map-reading," "Finding Your Way," and "Measuring Distances" will prove of real value to those who are venturing into new and unknown territory.

The volume is thoroughly illustrated by excellent drawings from the pen of Charles E. Cartwright.

P. B. Samson, President,
The Great Lakes Inter-Camp Council.

PHYSIOLOGY. V. H. Mottram. W. W. Norton & Company, Inc., New York. Pages 1 to 279 inclusive. $3.00.

This new text of Physiology is a welcome addition to the text. Physical education teachers will be particularly interested in the clear analysis of the central nervous system covered in the first three chapters of the text. Throughout the text many facts are given that will be of help to physical education teachers. The text includes some very good references placed at the bottom of individual pages. The Table of Contents gives a good general idea of the subject matter. The book is fairly illustrated.

CONTENTS

James H. McCurdy, M.D.
Professor of Physical Education,
Y.M.C.A. College, Springfield, Mass.

EDUCATIONAL OBJECTIVES OF PHYSICAL ACTIVITY. By Frederick Rand Rogers, New York. A. S. Barnes & Company, 1929. VII-109 pp. $1.00.

No one can doubt the sincerity and noble purpose which prompted Dr. Rogers to write this useful book.

Part I analyzes the philosophy, method, and program of physical education. Although this section is not easy to read, one is immediately impressed with the deeper meanings which underlie the activity program. Physical education is herein characterized as an educational agency of growth and service. The author says, "'Activity leading to further activity' is called 'growth.' It will be discovered that organisms with the power of self-improvement are happiest and most satisfied when they are 'growing' fastest; that is, when they are most active in projects which are developmental in effect. Herein lies a criterion of 'service,' too." Worthy activities in physical education present the three types of pupil response—physical, mental, and social—which are to be found in approved forms of academic education. All activities in either field may not contain equal portions of the three types of response, but just as one type may be associated with or supplement another, just so physical education may be associated with or supplement academic education.

In Chapter III the reader is introduced to a conception of physical education which is rapidly gaining favor: "It is possible, however, to contrast 'physical' with 'mental' education and to observe that physical education may have a program as broad as the mental education program. In the latter we have algebra, English, biology and so on; in the former we have calisthenics, drills, and games."

Part II contains a number of general and specific suggestions for elementary and secondary school teachers, as well as for physical educators and school administrators. The treatment of these suggestions is both pleasing and instructive.

The last fifty pages of the book are devoted to an annotated bibliography and charts covering the items discussed in Part I. While one might question the use of so much space for this purpose, the references are exceptionally well selected and reviewed, and the charts show graphically the range and scope of the program.

Careful reading of the volume will re-

sult in differences of opinion between leading educators in this field. Such a condition is to be favored rather than condemned because open discussion of controversial issues leads frequently to professional growth and clearer understanding.

The book has already found a useful place in our educational literature and will be welcomed as a contribution to the field of physical education.

Clifford Lee Brownell
Columbia University

ENRICHED TEACHING OF PHYSICAL EDUCATION IN THE HIGH SCHOOL by M. N. Woodring and N. Schwendener. New York, Bureau of Publications, Teachers College, Columbia University, 1929. 140 pages.

The book is composed of an annotated bibliography covering a wide range of topics dealing with various aspects of physical education. Teachers in this field will find here a ready reference to the best sources of material relating to: athletics, camping, rhythmic activities, equipment, festivals and pageants, professional reading, recreation, professional associations, and tests and measurements. Each reference bas been reviewed carefully and the salient features enumerated. Great care has been exercised to include the exact title of the reference, its author, name and address of the publisher, year of publication, and present cost.

The book will be of exceptional value to teachers in service, to students enrolled in normal schools and colleges who are pursuing major courses in physical education.

C. L. Brownell
Columbia University

THE DEEPER MEANING OF PHYSICAL EDUCATION. Dr. Eugen Matthias. Translation by Carl L. Schrader. A. S. Barnes and Company, New York, 1929. 88 pages, cloth, $1.

This book is essentially a presentation of the author's analysis of the underlying principles of physical education, with hints at their philosophic relations. He points out specifically some of the basic biological facts in which the science of physical education is rooted, and which must become clearly known and determine its policies and growth. The application of this knowledge will enable teachers not only to perceive, but also to realize more fully, the broad possibilities of physical education in promoting the health, the social and moral efficiency, and the culture of their pupils.

All through the discussion there is an undercurrent, or thread, impressing one with the integrity of the life force which tends always toward the integrated development of the physical, social and cultural potentialities of children and youth. But, to make the exposition clearer to the reader, the author deals separately and specifically with physical education in relation to "the body-sense," "the psychical meaning," and adaptation to development and need.

Nearly half the book, which is perhaps the most practical part of it for teachers, is devoted to "Problems for Physical Education During the Years of Development." One section relates to the problems for childhood, another to physical objectives during adolescence, another to the psychical problems during adolescence, and still another to the problems of late adolescence. Here the author stresses, among other things, the importance of selecting and controlling activities intelligently to meet the developmental changes that are taking place, physically, socially and psychically, and points out the differentiated needs of boys and of girls, based on the differences in their normal development. Here also are important implications for athletics.

Mr. Carl L. Schrader, state supervisor of physical education for Massachusetts, has performed a service to physical educators in this country in giving us an English translation of these lectures by Dr. Matthias from the original German, and those who read and digest it will send him a note of thanks.

W. W. H. Mustaine,
Supervisor of Physical Education
State Department, New York.

PHYSICAL MEASURES OF GROWTH AND NUTRITION. By Raymond Franzen. School Health Research Monograph

No. II, American Child Health Association, 1929, 138 pages, $1.

During 1927-29 certain "field measurements" of some 7500 public school children of the fifth and sixth grades in schools from thirty-eight states were secured by trained testers of the American Child Health Association in an endeavor to determine a thoroughly valid method of measuring nutritional status. The volume listed here is an eagerly anticipated analysis of the anthropological data resulting from these field investigations. Though the foreword declares that the measures presented are "argued for wholly as research devices" nevertheless "Chapter VI does indicate the direction which an adaptation to school needs will take when and if this proves desirable."

It is impossible to summarize in a few words the highly significant discoveries and procedures advanced in this monograph which should be read by every person intimately concerned with the accurate measurement or treatment of malnutrition in school children. Perhaps its most outstanding contribution is in its revelation of the very great differences between physicians' conceptions of what constitutes "malnutrition." The conclusion is fully justified by experimental-statistical proof that "agreement between ratings of nutritional status made by physicians (using their own methods) *is too small to endorse this form of measurement*" and "an analytic rating scale using forty-six items of judgment does not satisfactorily improve these ratings." The study shows, moreover, that "the composite of twelve objectified measures (those developed and used by the American Child Health Association staff) agrees more closely with the ratings of any physician than this physician agrees with his colleagues."

These and other conclusions are contained in Chapter I alone. Other chapters reveal such important discoveries as the following:

"The correlation of height with weight is not nearly as high as the correlation of other skeletal combinations with weight . . ."

"Girth of upper arm and calf include a large proportion of that element of weight not represented by bony framework."

"Amount of subcutaneous tissue apart from its relation to muscle size is entirely uncorrelated with body build."

". . . the female is more variable than the male in the traits measured between 7½ and 12½ (years) inclusive."

It is especially significant that muscle size and subcutaneous tissue were found to be of great value in determining nutritional status. These findings corroborate the judgment of others that the muscles play a major role in normal life and growth.

The measures used by the American Child Health Association field workers included height, weight, width of shoulders, breadth of chest, depth of chest, width of hips, several girth measures (of the deltoid, upper arm flexed and relaxed and the calf) and several measures of subcutaneous tissue. Measuring technique was standardized.

The volume includes some hundreds of correlation coefficients, the basic data, and a review of the statistical techniques used. It is in every way a thoroughly complete, accurate, scientifically conceived and executed monograph, which contributes many important new truths to the field of anthropological measurement.

Frederick Rand Rogers
State Director of Health and
Physical Education, New York.

AMERICAN COLLEGE ATHLETICS. Howard J. Savage and Staff Bulletin 23 of the Carnegie Foundation for the Advancement of Teaching, 522 Fifth Avenue, New York. Pps. xii+383, 1929. No charge.

This bulletin is the product of several years of intensive historical and descriptive research into the problem of American college athletics. A staff of four men spent from two to six days each visiting one hundred and thirty institutions, investigating all phases of present-day college athletics. This was preceded by careful historical studies of the past of college athletics, particularly of its administrative history.

Perhaps the outstanding impression that

one gathers in studying this book is that the writer of the book has approached the study with certain preconceived opinions and that the discussion and conclusions are colored throughout by these opinions. The influence of this is particularly subtle but is evident from the preface, written by the President of the Foundation, to the last chapter.

The book opens with an excellent history of athletics in the colleges, stressing the development of athletics and the history of attempts at control of athletics. This is followed by a fair history of the amateur code. From this point the careful student of the book begins to be a bit critical.

The fifth chapter takes up the administrative control of college athletics and it would seem to us stresses rather over much the negative side.

The next section is devoted to a study of athletic participation and its results. This wanders into wide fields running all the way from results on longevity through the study of the effects of scholarship to the moral effects. This chapter is one from which a good deal of controversy might arise.

The section on the hygiene of athletic training which considers particularly the effects of injuries is exceedingly illuminating.

The next section gives an excellent review of the evolution of the coach together with many of the forces which influence his work and his decisions. This is followed by a section on extra-mural relations which stress the influence of the alumni, many effects of intercollegiate rivalry and what different college organizations are doing about it. The section devoted to the relationship of the A.A.U. would seem to be rather unsatisfactorily treated at least so far as the relationship of the A.A.U. to non-athletic club bodies in the U.S.A. itself. There has been rather a one-sided presentation of this controversy.

Chapter ten is the one which has started up such a hornet's nest in the colleges. This is the discussion of recruiting and subsidizing of athletes. The chapter seems a bit cynical and there is a suggestion throughout that while certain things were not actually seen they were somewhat suspected.

The next chapter—the press and college athletics—should be read by every physical director. It gives an excellent presentation of the problems confronting the press, what they are doing about it and what the colleges or other institutions can do about it.

The last chapter is a discussion of values in athletics. This chapter rather stresses the negative side and while giving you an appearance of balanced consideration, implies that the character and social values particularly have been much over-stressed. This is probably undoubtedly true. It would seem, however, at least worthy of suggestion to have included the statement that one of the reasons why greater values were not apparent was because there had been no direct educational effort to attain them. A coach who simply throws out a basketball to a group in a gym would hardly expect to develop a high-grade basketball team. About the same pedagogical method has been used in securing character education results in physical education.

The reviewer would like to reiterate his statement that this is an exceedingly valuable contribution and one which should be carefully and critically read by every physical educator. It is to be hoped that this publication will be followed by others, developing different phases covered in this report more in detail. The research worker would probably feel uncomfortable over the fact that this report burns over in a somewhat superficial way many fields of historical and descriptive research. The implication throughout the book is that there is material in the files of the Carnegie Foundation to develop each of these fields very much further. Other workers, particularly graduate students, will hesitate to undertake the study of some of these problems without knowing whether or not such a study is apt to be rendered useless by having another publication come out from the Foundation just before said student's dissertation is ready to print.

C. H. McCloy
University of Iowa

RECREATIVE ATHLETICS by the Playground and Recreation Association of America, 200 pp. A. S. Barnes & Co., New York, $1.00.

This is a much revised and enlarged edition of a small pamphlet previously published. The book is packed full of an enormous amount of miscellaneous material of the type not readily available in one volume elsewhere. The first chapter discusses the essential factors in an athletic program, particularly from the standpoint of playground administration. There is however much of value to the school or Y.M.C.A. The second chapter discusses the conducting of athletics, giving a number of grading or classification schemes, eligibility standards and details for the working out of many types of tournaments in the intramural contests. This chapter gives many of the methods of conducting mass competition. The third chapter gives many examples of special activities and stunts, quoting from the programs of different cities. Play days are discussed in detail, picking from the successful programs of successful communities. The administration of track and field athletics for various age groups and for various purposes together with the set-up of swimming meets and water sports is also adequately presented. Together with both of these subjects is included large numbers of special games or stunts, novelty races, etc., which go well in demonstrations, exhibitions, and special programs.

A chapter is given to winter sports of various kinds, most of which could easily be adapted for use by schools, playgrounds and Y.M.C.A.'s of the northern states.

The organization and administration of athletic programs takes up almost a third of the book. This combines a great deal of material taken from the successful experiences of a number of cities and presents in addition detailed activity lists for different age groups and the constitution and by-laws of different types of athletic organizations.

This booklet is well compiled and contains in it a great deal of matter. There is no index but the table of contents is a fairly adequate guide to the material. It is well worth having and should be of frequent use to the physical director.

C. H. McCloy

PAGEANTS AND SPECIAL PROGRAMS

The following four publications by A. S. Barnes & Co., New York, present material useful in the presentation of pageants and programs for special occasions. Most of these are for the younger age group.

1. *An English May Festival,* by Linwood Taft, 15 pp., 1929. 50c.

This is the pageant of Queen Elizabeth's court and takes in the Sir Walter Raleigh episode with interludes of Robin Hood and his merry men. It is well adapted to physical department use.

2. *A Pageant of the Seasons* by Ethel E. Holmes and Nina G. Carey, pp. 23, 1929. 75c.

The nature of this book is indicated by its title. The spoken parts are given in detail together with suggestions for presentation. The music is however in general left to the discretion of the individual producing the pageant.

3. *Mother Goose May Day* by Kathleen Turner and Marguerite Wills, 31 pp. 1929, $1.00.

This is a pageant more adapted to school and playground use than to that of any other organization. It will be of service however in community centers and junior summer camps.

4. *Programs for Special Occasions* by Marion Kennedy and K. I. Bemis, pp. 105, 1929. $1.50.

This book contains programs for various "weeks" such as book week, clean-up week, conservation week, fire-prevention week, garden week, health week, safety week and a number of others. The programs are primarily those for elementary schools and are generally simply spoken parts. The book is of value to school, church and community organizations who may wish to present this type of material.

The first three books reviewed in this series contain programs for the reproduction of which permission must be obtained from the publisher and in some cases a small royalty is charged.

C. H. McCloy

THE MEASUREMENT OF GENERAL ATHLETIC ABILITY IN COLLEGE MEN by Fred W. Cozens. 192 pp. The University of Oregon Press, Eugene, Oregon, 1929. $1.00.

This volume is the doctor's dissertation of Dr. Cozen's and presents an exceptionally thorough study of the measurement of *general* athletic ability. The book first analyzes what general athletic ability consists of and then presents the results of a study of a large number of activities designed to test each of the components of this general athletic ability. The rules for each of the events used are given together with the detailed statistical analysis of the material. This part of the book will be of little use to the average physical educator as it is considerably too mathematical for his use. It does not however detract from the book as the remainder of it gives several alternative batteries of tests together with scoring tables for scoring said tests. The book is worth studying, particularly to the physical educator promoting athletic activities for high school boys and young men. It represents the best study made to date in this field.

C. H. McCloy

THE PROFESSIONAL EDUCATION OF MEN TEACHERS OF PHYSICAL EDUCATION IN PRUSSIA by Frank L. Oktavec, Ph.D. Contributions to Education, 369. Bureau of Publications, Teachers College, Columbia University, New York City, 1929. Cloth. $1.50.

The author's purpose is to show how certificated men teachers of physical education are being prepared in Prussia, Germany.

While articles and books have been published about the present status of education in Germany, but little has been written dealing with the program of physical education; yet every visitor to Germany is impressed with the tremendous impetus physical activities have received since the war. This book describes the part modern physical educators play in this movement.

The educational changes established by the new constitution of Germany have increased the opportunities for and stimulated education in general. Some phases of physical education which have received renewed emphasis are: the movement toward outdoor activities which is stronger in the present day Germany than it ever was before; air, wind, and sunlight are looked upon as preservers of health and strength; Rhythmic Gymnastics, Prophylactic and Compensatory Gymnastics, and Koerperschule, and Natural Gymnastics of which Gaulhofer and Slama are the advocates. There is an absence of the old style free exercises; increased interest in tumbling, track and field work, hiking and swimming; a slight decline in apparatus work is noticeable. The youth movement is also shown to have made tremendous strides forward since its inception in 1904.

The author is of the opinion that fundamental principles and a philosophy of physical education are still lacking. Nevertheless he quotes innumerable authors in his references who deal with methods, aims, character and personality development, with the psychology and physiology of activities, and their influence upon the development of mentality. Furthermore, in his last chapter he presents a philosophy of physical education underlying the work.

The greater part of the book, however, is devoted to a study of the administration and organization of the Preussische Hochschule fur Leibesuebungen, every phase of which is given in detail.

The courses in other Prussian universities are modelled after those of the "Preussische Hochschule fur Leibesuebungen." Physical education is given here as a minor in connection with two other major subjects. In this minor "twice as much time is spent for teaching activities as for teaching theory courses." Perhaps Goethe's thought "Grau ist alle Theorie" underlies their curriculum construction.

The book arouses a desire to see the "Preussische Hochschule fur Leibesuebungen" in operation and is very stimulating, not only to those engaged in the preparation of teachers of physical education, but to others as well. It will serve undergraduate students for references in the History of Physical Education; directors of and teachers in teacher train-

ing institutions; educators in general; and teachers of physical education who are still students of the subject. There is a table of contents, but no index. An abundance of varied and valuable references are given.

Emil Rath
President Normal College of the
American Gymnastic Union,
Indianapolis

INDIVIDUAL GYMNASTICS. The fourth edition of "Individual Gymnastics" by Lillian C. Drew. Lea & Febiger. $2.25.

A 1929 publication has brought up to date a reliable source of information for the student and teacher of Therapeutic Gymnastics. As this type of gymnastics is being widely recognized and given its proper place as a part of every program the need for a text book such as Miss Drew has developed is an urgent one. The organization is good, giving just enough of the principal points in Anatomy to refresh the mind and not be a tiresome repetition of a previous study.

The emphasis on posture is none too strong for that is the larger part of the work of a teacher of Therapeutic gymnastics whether in classes or with individuals.

The subject of the correction of "Scoliosis" is very conservatively treated and rightly so, for prescriptions for this defect must be such individual ones and so much harm could be done if a more detailed explanation of exercises were given and the book used by a poorly trained teacher. The discussion of the causes of Scoliosis with the idea it gives of prevention rather than simply correction is most interesting. Foot defects are ably analyzed and exercises given which will be of interest to the pupil as well as the teacher.

The latter part of the book is devoted to pathological conditions which are treated by exercise. Here the simple, direct statements, the use of few technical terms and the advice about hygiene and cooperation with the physician, make a sane presentation of difficult conditions. The Orthopedic Examination would be more complete if the Silhouettograph were used instead of the out of date schematograph and if more space had been allotted to the record of the feet. On the whole, it is a very satisfactory book and to be recommended as a text.

Helen D. Denniston, M.D.
University of Wisconsin.

PHYSICAL EXAMINATION AND DIAGNOSTIC ANATOMY by Charles B. Slade. W. B. Saunders Co.

This fourth edition of "Physical Examination and Diagnostic Anatomy" by Dr. Slade brings up to date a very concise and well arranged book for medical students and physicians. For teachers and students of Physical Education the book contains very little of value except the Chapters on Inspection. These chapters, 1, 3 and 4 emphasize many points to be noted during inspection, other than the postural or orthopedic defects.

The generally accepted attitude that the examination made by the Physical Education teacher shall be one of inspection and not a medical examination including palpitation, percussion and auscultation, would make the rest of the book of little use as a text for the Physical Education group, however interesting it may be.

Helen D. Denniston, M.D.
University of Wisconsin.

THE NEW HEALTHY LIVING, by Winslow and Hahn. Book One—312 pages; Book Two—438 pages. Many illustrations and diagrams. Charles E. Merrill Co.

In "The New Healthy Living," Book One and Book Two, Winslow and Hahn have given to health literature a charming and valuable contribution.

The two volumes are written for the use of the children in the late elementary and Junior High School grades but are also good sources of information for the teacher as well.

They are outstandingly successful in accomplishing the objectives stated in the preface: That health education should be positive and stress the splendor of health; that it should be practical and concrete; that it should have definite and satisfying intellectual content; that it should correlate with other subjects and with education in social responsibility and citizenship.

In accomplishing these objectives the subject matter is skillfully worked out in

accordance with the dominating interests of children and adapted nicely to their age level. It expresses the important phases of healthful living in a behavior medium that should stimulate the children to want to do health activities.

The stories and historical incidents chosen are simple and real situations, not mixtures of fact and fancy and are interestingly and charmingly told. The problems suggested are suited to the present day living of children and are reinforced at the end of each chapter by very helpful questions which the child can use for checking his habits and as a guide in doing health activities.

The factual side is scientfically correct, conservatively stated and sound. There seems to be no spots of exaggeration of facts or over claim and no points that are misleading or questionable.

The books are rich in many specific suggestions on correlation and outline many ways in which children can tie up the study of health with other things that they are learning.

The authors show a fine understanding of educational methods and have developed the books on a psychological basis that is unusual to find in such material.

The books have such unique charm and so express the interest and point of view of the children that any teacher should find them valuable in making health teaching dynamic and successful.

Alice Evans
Physical Education for Women,
University of Michigan

BASKETBALL FOR COACHES AND PLAYERS by George F. Veenker, Basketball Coach, University of Michigan. Reviewed by Ross L. Allen, Health Education Teacher, Rochester, N.Y. A. S. Barnes. $3.00.

Michigan's new basketball coach, George F. Veenker, has had considerable experience with high school boys as well as college men in the coaching of basketball. This factor has been a potent influence in his writing "Basketball for Coaches and Players," a successful and interesting book.

It is natural for the mature basketball coach to think "here is just another book on basketball." Mr. Veenker's book has some unique features which justify its publication. The section on team offense, including several intelligible diagrams of practical means of "advancing the ball," is probably the greatest contribution of his effort. The dribble, stop, and "quarterback pass" is used in many of his plans of offense.

The strong emphasis on fundamentals shows clearly the "common sense" nature of this new work. Much attention is given to the technique of acquiring proficiency in this first step toward individual and team success.

A chapter on the duties of the manager of the team will be helpful in teaching the candidate for this position of such diversified labor. Much of the coach's time and unnecessary activity will be saved for more important work if the coach will teach the student manager what is expected of him before the basketball season begins, while it is in progress, and after its completion.

As one continues to read basketball books by various authors, he naturally comes to the conclusion that it might be an excellent idea for the various national organizations in basketball to standardize or formulate a basketball vocabulary which could be clearly and quickly understood by the beginning coach and player. It is distressing to the inexperienced coach and player to learn that one technique may have five or six different terms to describe it. The "quarterback pass," a term used by Coach Veenker to clearly explain one of the features of Michigan offense, would be profitable to adopt.

"Basketball for Coaches and Players" taken all in all, is a fundamental and useful text for high school and college players. It stresses the really important assets of basketball and omits the non-essentials. It is a book containing material that has been tried out practically and found successful.

Ross Allen,
Rochester, New York

THE PREVENTION OF DISEASE IN THE INDIVIDUAL. By Kenelm Winslow. W. B. Saunders Co., pp. 431, 1929.

A text on personal hygiene and on the causes and prevention of diseases, with

suggestions as to proper procedures on the part of the layman.

The three chapters on personal hygiene contain particularly good discussions of foods and diet and care of the skin and hair. The material on alcohol and tobacco is gratifyingly sane and worthwhile.

One chapter is devoted entirely to a painstaking and valuable discussion of the early signs, symptoms, and means of prevention of cancer. It contains facts that should be a part of the information of every person. No effort should be spared by either physicians or laymen to get under control this scourge, which is rapidly creeping toward the top of the list of causes of death in the United States. This increase is due in part, to be sure, to the fact that as we control communicable diseases a larger proportion of our population live to reach the cancer age—that is, over forty years.

Another chapter is devoted wholly to a discussion of prevention of disease in children. Also one chapter discusses deficiency diseases, and disorders of nutrition—beriberi, scurvy, rickets, pellagra, adolescent goitre, obesity, and diabetes.

This revision of a text that has gone through six previous revisions and reprintings since 1916 is a much more worthy effort to give detailed, but simple, information on personal hygiene and on disease prevention, than is done in most similar texts. An excellent text for college and teachers' colleges use, where sufficient time is available for a real study of these health facts.

Chas. H. Keene,M.D.
University of Buffalo

HOME NURSING AND CHILD CARE. By C. E. Turner, Nell Josephine Morgan, and Georgie B. Collins. D. C. Heath, 1930.

This book is one of a series dealing with class room presentation of health, and has been developed by the classroom method. It is intended for use in the late junior and early senior high school, and introduces to the student fundamental physiological facts. The emphasis, however, is given to the practical application of these facts to healthful living.

The material is well organized and is given with unusual directness and simplicity. The technical facts are written in short sentences and although scientific terms are used, they are always explained. The language and thought are well within the comprehension of the average junior high school student. Each chapter has a few questions at the beginning to introduce the main facts of the text following. At the end of each chapter a number of suggestions for discussion are given. Simple experiments are also described which require very little equipment and can be carried on by the student in any class room. The book has a number of good diagrams and illustrations and they have been chosen carefully so as to stimulate the interest in the subject of health. It is unfortunate that so few of these illustrations make any especial appeal to girls. A list of health habits in the appendix make possible the checking and review of the health training of the preceding grades.

Glenadine C. Snow, M.D.
Director of Health Service,
Michigan State Normal College, Ypsilanti

HOME NURSING AND CHILD CARE. By C. E. Turner, Nell Josephine Morgan, and Georgie B. Collins. D. C. Heath, 1930.

This book has a goodly number of points to commend it. Its statements are clear and accurate and its style avoids the repetition and irrelevance which has characterized some textbooks on this subject. While it is simple enough to be used in junior high school, it will make an excellent reference book for the home. The attitude of the book is scientific but at the same time the text is not cumbered with technicalities. The simplicity of the statements is never at the expense of completeness or accuracy, and the material is satisfactorily organized.

There are a number of features which deserve special mention. The chapter headings really describe what one may expect to find in each chapter, and a good index assists in finding special topics quickly. A glossary explains the few words of the text which have technical or scientific connotation. A few of the numerous illustrations seem beside the point, but for the most part they are clear, simple, and directly illustrative of

the text, helping the reader to visualize practical situations. Review questions at the ends of chapters help the pupil to check his understanding of the text, and the lists of suggested activities furnish ways to link knowing with doing.

Teachers of home nursing will undoubtedly welcome this dependable addition to the list of available texts on the subject.

Carolina A. Supé,
School Nurse, Roosevelt High School, Ypsilanti

GOOD TIMES FOR ALL TIMES by Nina B. Lamkin, 368 pp. Samuel French, Publishers. $4.00.

A book with an immediate appeal to the recreation leader or the teacher who must plan entertainment for any special occasion. It is an encyclopedia for completeness, is attractively illustrated, and its author has had the practical experience and leadership to choose the activities on the basis of actual success. Suggestions are given for family, church, school and community gatherings; for holiday occasions; for children and for adults; for girls and for boys; and for men's organizations and women's organizations.

There are special chapters on dances for plays, festivals, and pageants; on costumes and costuming; and on the planning of plays from the standpoint of lighting, stage sets, and makeup.

One of the most valuable parts of this book is its many references. In addition to the many suggestions given for every occasion, a compact bibliography on each section makes a most handy reference book for the teacher who may wish to consult other material.

Elmer Mitchell
University of Michigan

A HISTORY OF WOMEN'S EDUCATION IN THE UNITED STATES (2 vol.) 551 and 473 pages. Thomas Woody. The Science Press. $10.00.

Apart from the general importance of these volumes as a most needed contribution to the neglected subject of women's education, they are of distinct interest to physical education because of Chapter 3 in Volume II, which is devoted to Physical Education." The early chapters of Vol. I, which treat of the education of women—among nature peoples, in the earlier civilizations, and in other contemporary lands—also have incidental treatments of physical education in its relation to the complete educational program.

In the earlier history of girls' education in the United States, the author lists the determining influences as "transplanted ideals and practices, plus primitive environment." New influences, i.e., "increasing wealth and stability of settlements, relaxing of religious restraints, and growth of culture in municipal centers, gave a new tone to their education in the last half of the eighteenth and the early years of the nineteenth century." During the last one hundred years the "vastly changed economic place and function of women, the extension of suffrage, transcendentalism, the movement for equal rights and many other reform movements concerned with women," have brought about new opportunities for women's education.

The chapter on Physical Education in Vol. II comprises thirty eight pages. Dio Lewis and Catherine Beecher are given prominence as early leaders in women's physical education. The section is interesting historically because of the many quotations and elucidations of earlier (and what seem to us fantastic) notions of women's health, of formal physical exercises, and of proper dress and demeanor. The trend toward athletic sports since 1900 is pointed out, but on the whole the modern treatment is superficial if one is looking for guidance in the solving of present day problems. The chapter concludes with a brief but interesting account of the history of teacher-training institutions.

Elmer Mitchell,
University of Michigan

THE FUTURE OF INTERSCHOLASTIC ATHLETES. Frederick Rand Rogers. Bureau of Publications, Teachers' College, Columbia. 138 pages.

The future of Interscholastic Athletics, by Frederick Rand Rogers, is challenging and stimulating to anyone who has given the question any serious thought, and who is at all concerned as to "The Fu-

ture." It should be of much interest not only to physical educators and coaches, but to superintendents of schools and school boards who have much to do in formulating policies.

In this writer's judgment, while the question of winning needs no undue emphasis, we can hardly slight its significance. In the light of man's biological and sociological struggle unquestionably the desire to win has been a dominant characteristic. In any contest between individuals or groups on an intellectual, social, or physical basis, one side will emerge superior to the other in most instances unless artificial barriers are set up.

Dr. Roger's statement relative to state championships in which he presents arguments both for and against such events is a direct challenge to state departments. It is this writer's understanding that approximately thirty states at a recent meeting of state directors voted against participation in national championships, while comparatively few voted against state championships.

It is quite debatable whether the increase in attendance at athletic contests is a significant sign of degeneracy. Better transportation, and increased leisure time are two of the elements mentioned by the author as having much influence on this phase of the subject. In addition to these, may be added a growing interest in sports and out-door activity, and a material growth in student bodies and alumni. If the curve of increased participations in out-door activities approximates the curve of increased interest in attendance as a spectator, the outlook may not be entirely a pessimistic one. A question bound to be raised by many is what would you offer as a substitute.

Probably one of the most talked of departures from the traditional which is discussed in the book, is the coach's removal from the game. If we tend toward modern educational procedure as expressed by Dr. Courtis, in which he states that educational outcomes are dependent not only on the pupil executing the plans, but in addition to the extent in which he participates in the purposing, planning, judging and generalizing of the project at hand, we may readily see the educational value of such a procedure. It is this writer's feeling that many high school coaches would gladly be relieved of the pressure placed upon them to develop winning teams and devote their energies toward the educational outcomes of interscholastic activities; but the attitude of superintendents, school boards and committees needs to be modified considerably before such a transition is accomplished.

Dr. Roger's position relative to the high school boy playing as a professional as a partial solution of the problem, may be questioned. Such a procedure would not return the game to the boys, but would result undoubtedly in greater adult domination, and the use of boys as pawns to further the ends of promoters whose sole purpose would be exploitation for profit. We can hardly make a comparison between athletics and other extra-curricular activities, as he does, because there is no such general interest or emphasis on any other extra-curricular activity. It is quite doubtful whether the boys or girls would benefit by a policy which shifted control of any school activity from the school to an outside individual or group to promote as they saw fit.

In conclusion may I say that no review could do more than partial justice to the book. The problems raised are vital, and though you may not agree entirely with Dr. Rogers, you will find the book a most stimulating one, and well worth reading.

J. H. McCulloch,
Professor of Physical Education,
Michigan State Normal College,
Ypsilanti

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